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EDITORIAL NOTES—GAS, &c.

Railway Troubles and Coal Supply.

FOR the time being, an all-absorbing question for those upon whom hang the burdens of management in industry is not the price of coal, but the probability of a strike of railway labour, and its effect upon the conveyance of coal and other raw material and manufactured goods. Numerous gas-works are dependent not only for the delivery of the whole of their raw material by rail, but for the disposal of their secondary products under contract. The prospect of a railway strike in winter is indeed a serious one for them; and we can recall no time in which the gravity could have been aggravated to the extent that it would be in the coming winter through a chain of circumstances of which home users of coal are the victims, to the profit of coal owners. That chain of circumstances has brought a demand for British coal the like of which, in volume of business, has never been experienced before; and, even with the railways in a state of normal activity, we hear complaint of congestion of goods traffic and of ports blocked. What would be the condition in winter, with a demand for coal multiplied many times compared with the summer, with what traffic that would be possible disorganized through foul weather, with unprecedented export contracts in hand, and with a railway strike pending, it is impossible to say; but it is sufficient to make the manager of a big industrial establishment dependent on a continuity of traffic, tremble to contemplate. We are not taking a despondent view of the future, but are merely cogitating over what may possibly be. And it must be conceded that he is a wise general who, by the omens permitted him, looks to the worst possible contingency, and provides for it to the utmost of his power, though, in truth—regarding the gas manager as the general—present pressure at the collieries and between them and works imposes irritating limitations to that power. Happy are those gas managers with capacious and well-filled stores, and with regular present deliveries. But all are not so fortunate.

Assuming the worst will happen, there is breathing time. We are yet, it is hoped, several weeks from the greatest severity of the winter months; and it is still an open question whether or not there will be a railway strike. If there is to be one, if wise counsels do not prevail, November is mentioned as the earliest (giving time for a ballot of the men) that it could take place. Therefore, in an industry dependent upon railway borne coal for its almost sole raw material, and with the heaviest demand for its produce approaching, the position is such as to call, between now and November, for the straining of every nerve to get into stock as much coal as possible, though in the event the preparation may, fortunately, be shown to have been wasted effort. It will not do to be lulled by any prophetic utterances as to a railway strike being impossible into a feeling of false security, for such prophecies at the present are as worthless as the ill-forebodings of the darkest pessimist. We have not the slightest suspicion that the threat of a strike, if the Amalgamated Society of Railway Servants cannot have the full measure of compliance with their demands by peaceful coercion, has not been made with all earnestness by the leaders. With the justice or otherwise of their demands, we are not immediately concerned; our only theme here being the likelihood or otherwise of a strike. Incidentally, however, there may be an expression of sympathy with the Directors of the large railway systems who desire to manage their own affairs, and settle disputes directly with their employees, without the intervention of any Union. The workers on any railway system, preferring any desire or having any grievance which they believe require remedying, are of themselves, if there is unity of feeling in the matter, strong enough to present a cogent case for consideration by the Board of Directors, and, what is more, compel its consideration.

This brings us to an important point in the considerations affecting the prospects of the culmination of the menaced strike. According to published statistics, the members of the Amalgamated Society form a minority of the workers on the railways. There are, so the figures plainly state, about 580,000 railway employees, of which number 220,000 are eligible for membership. But the latest published returns only credit the Union with a membership of 93,000. The membership therefore only accounts for a small percentage of the men engaged on the individual railways. Apparently there is supreme contempt on the part of the Amalgamated Society for the views of the non-unionists, and for those of the Associated Society of Locomotive Engineers and Firemen; while, by the force of numbers, it should be the non-unionists who should, if there be cause for grievance, initiate movement in the matter, and dictate to the unionists the lines of activity in securing redress. The leaders of the Amalgamated Society aver that the non-unionists are joining their ranks at the rate of 1000 men a week, but it will at that rate take a great many weeks to capture the eligibles for membership, to say nothing of the 360,000 ineligibles. It will therefore rest entirely upon the action of the non-unionists whether or not any effective stand could be made in the event of a strike. Perhaps an equally important factor in the situation is that the Associated Society of Locomotive Engineers, with a roll of 19,000 members (mostly engine drivers), have a programme of their own, and will not support that of the Amalgamated Society by going out on strike. Then regarding finances. The Amalgamated Society are not in such an opulent condition that they could continue a strike for any lengthened period; but they could do so, by depleting their reserves, for a sufficient period to partially disorganize the affairs and disturb the comfort of the whole country. At the end of last year, the accumulated funds of the Society only amounted to £362,732; and the then number of members was 70,130—the *per capita* average of the funds therefore being £5 3s. 5d. That average sum would not go far in a strike. Under such circumstances, the leaders of the Amalgamated Society are sufficiently alert to know that the onus of extreme measures must be thrown on the members generally. The ballot that is to be taken is a momentous one for the leaders who have to the present shown so much persistence and intrepidity. There will, however, be time for excitement to cool, and for loss of heart on the part of many members, before the ballot-papers (which it was announced would be distributed at the beginning of this week) have to be returned—the men not being insensible to the ulterior risk of loss of employment and pension. A railway strike would do an immense injury to the country; but the men know that, from their individual standpoint, their own loss might be irreparable. Taking all these matters into consideration—though it is a dark avenue down which we are looking, and the end of which is unknown—there are the conditions which give hope that the worst will not betide. But it is the possible worst that every management will, in their prudence, contemplate at the present time.

While the labour position on the railways is the most portentous matter for consideration, it does not escape notice that the Railway Companies themselves have not been oblivious just lately to the fact that they are in a position to command little pickings (which in the aggregate mean something enormous) out of the coal situation. There is great dissatisfaction among the coal dealers over the decision of the Companies to charge in future on the net 20 cwt. basis—that is to say, with no allowance for wastage. But there is a prospect that the Board of Trade will intervene, and hold a conference, in regard to this matter. Additional income has also been derived by the Companies from increased siding rent payments; and a new set of regulations, affecting the owners of private waggons, also came into force on Aug. 1, with benefit attached for the Railway Companies. Now, the Companies have given notice that they will increase the rates by ½d. and 1d. per ton (according to ports) for carriage

of coal, coke, breeze, and patent fuel "for shipment," which term, we understand, covers all coal and the other mentioned materials not carried by rail to their ultimate place of use or sale. The charges for waggon-hire on coal, coke, breeze, and patent fuel for shipment for distances exceeding 50 miles are also to be increased from 7d. to 8d. per ton. These additions, small as they appear separately, and "at per ton," all tend to increased costs, to be extracted from the pockets of the unfortunate consumer of the coal and of the produce of its utilization in industry.

"Coalite" Breaks Silence.

When confidence is on the wane, it is not an easy task to rehabilitate it. The confidence of many of those who have taken shares in the speculative enterprise known as the British Coalite Company, Limited, has, since they signed and despatched their application forms in June, been declining; and it was the duty of the Chairman of the Company (Mr. A. G. Kitching), at the statutory meeting on Friday, to attempt the task of restoration. His attempt was a brave one, considering the molecular character of the solid matter he had to present to his expectant audience. Truly, however, some of the shareholders were easily persuaded into sinking the burden of doubt which had oppressed them up to the time of the meeting; but others were not to be deluded by mere rhetoric and apparently a blissful ignorance on the part of the Board of what the Company actually possess in the way of exclusive privileges and rights. Perhaps in commercial, as in other matters, "where ignorance "is bliss, 'tis folly to be wise," but that does not square with our own views.

Let us examine the point as to what are the Company's exclusive privileges and rights. A considerable part of the Chairman's address was taken up with a defence upon the question of the validity of the Company's patents. As to precisely what these patents are only a modicum of information has been allowed to escape; for "acting on the advice of "eminent Counsel," the Company—as we have charged them with doing—"have deferred the publication of the specifica-"tions of the patents to the latest date allowed by the Patent "Office for that purpose." The point of interest about the deferment of publication is withheld, and that is the reason that induced "eminent Counsel"—whose knowledge of coal carbonization in general and of the Company's system in particular cannot be of an order that has in any way contributed to the eminence he has attained—to so advise the Directors of the Company. But if we have not the specifications of the patents, we have the "Coalite;" and that helps the man expert in carbonization to very fairly assay the value of the process. Now what is it the Company hold patents for? Is it for the system of producing the so-called "Coalite," or for the "Coalite" itself as a manufactured article? There is a marked and important distinction here so far as the Company are concerned; and it is on this point that the Board are either ignorant or, having the knowledge, do not care to confess to it before the shareholders. An ingenious person might, "after years of arduous labour" make "the great discovery" of a new way of boiling an egg, which would be "good subject-matter" for a patent in Great Britain, in Germany, in America, or elsewhere, and in regard to which the Patent Office Examiner—competent as that gentleman may be to distinguish differences or likenesses in process—might fail to find any anticipation. But the resulting cooked egg might not be any better than an egg cooked in the old familiar way. And the same with "Coalite." However successful Mr. Parker's system may be, however valid his patents may be for a method incorporating novel details, there are other systems, the growths from a process started a hundred years and more since, by which the same result in the way of a smokeless fuel can be achieved. Therefore it should be made clear to the shareholders that it is not the product itself that is the subject of the patent, but only one of several systems capable of yielding a similar product. We do not at present suggest that any copying of Mr. Parker's particular plant might not lay a person under the obligation of defending himself in an action for infringement; and, so far as we know, as the publication of the specifications of the patents have been withheld "on the advice of eminent Counsel," the Company might be able to uphold their patents. But, from the multitude of carbonizing systems extant, who can tell that the Law Courts might not ignore that "official Patent Office "Examiner" in whom such glorious trust is reposed by the "Coalite" Board, and come to the conclusion that Mr. Parker's invention had been covered by predecessors. As we say, that is an open question; the product of the system is quite another matter.

The Chairman made some flippant remarks about other smokeless fuel that has come on to the market, and produced under other systems of carbonization which do not infringe Mr. Parker's plant. Mr. Kitching's flippancy tickled some of the shareholders; but in after thought they may inquire of themselves whether flippancy constitutes any good proof. He spoke of certain gas companies having made attempts to produce "imitations" of "Coalite;" and he asserted that the most cursory examination showed that they had utterly failed to manufacture a smokeless fuel. With Mr. Kitching we are at variance in this, and challenge him to demonstrate that the Gaslight and Coke Company's "Carbo" (which he endeavoured to ridicule in a somewhat senseless fashion) is not equally as smokeless as "Coalite." He also spoke of coke containing 1 per cent. of volatile matter; and of "Coalite" (this being its virtuous characteristic) containing 12 to 13 per cent. But Mr. Kitching did not inform his audience—perhaps he was not aware of it—that there is no difficulty whatever in gas companies by their present plant, if there is a demand that will pay them to do so, dealing with their coal so as to leave in the spent charge an equal percentage of volatile matter. The proofs that have been afforded by the gas industry of the very modest privileges and rights possessed by the "Coalite" Company, were referred to by the Chairman as "imitations." If the Company hold patent rights for the product as distinct from the system, then the shareholders of the Company should demand, and demand at once, that the Directors should proceed against these imitators. The Directors, or rather their advisers, know better than to make fools of themselves.

It is a mistake—genuine or otherwise—on the part of the "Coalite" Directors to assume that gas undertakings fear their competition. They do not fear the competition; but those who are not sleepy are going to give the Company no quarter, nor will those who are wise give them any facilities for the profitable disposal of their gas, in order that they may be the better able to compete with them with their other produce. Let us emphasize this—*that it is just in those centres where a gas undertaking gives the Company facilities for disposing of their gas, where the conditions will be the most favourable for the Company entering into the keenest competition with their other products, and so with their benefactors.* We can well appreciate the strong desire that the Company entertain at this stage to hold friendly relations with the gas industry; the fear it is evident is on their side that the gas industry will not encourage their advances. The profitable disposal of the unpurified gas produced in making Coalite is the key to the Company's situation. If they cannot dispose of it, their competition in other directions cannot be conducted with the same effect. The Chairman referred, with some elation, to the fact that the Board are negotiating now with an important Gas Company for the supply of 500,000 cubic feet of gas a day; but he declined to say which Company this was, though it was expected the negotiations would be completed in the next few days. It does not say much for the Coalite Company—perhaps the Gas Company in question will note this—that, after all the several months' efforts that they have been making, they have not got any nearer than this with their negotiations with gas undertakings. Only one Company biting, and that Company not yet hooked! The only lands so far, according to the Chairman's speech, that the Company have acquired for works are at Barking and Wednesfield; if it were only at one of these two places that negotiations are pending with Gas Companies, one might make a shrewd guess at the name of the Company concerned in the announcement. But, after all, what do 500,000 cubic feet of gas represent? The non-technical shareholders applauded the goodly roundness of the figure; but if their dividends are to depend on such figures as this, those dividends will not be bloated ones. In the manufacture of "Coalite" about 5000 cubic feet of gas are produced per ton of coal; so that 100 tons of coal a day would yield this 500,000 cubic feet, and the same 100 tons of coal would probably represent a production of only something like 70 tons of "Coalite." And the income of the Coalite Company from the 500,000 cubic feet of gas, if supplied in the crude form, would merely be somewhere—what shall we say?—between £15 and £20 a day. Wherefore then this noise at a meeting of shareholders in a Company with three-quarters of a million of capital, over this expected modest

contract? However, we know that the Directors of the Company are straining every nerve to enter into contracts at one or more places other than Barking and Wednesfield. But most gas companies working under special statutory powers, subject to statutory obligations, will hesitate long—apart from the considerations already advanced—to take up the subservient position of distributors to a Company without any special statutory obligations and under no statutory control, and whose output of gas will be regulated by the demand for "Coalite." It is a serious position; and any gas company taking gas on such terms, without any control over the "Coalite" Company's operations, will be incurring a grave responsibility, and will always have to hold themselves in readiness with plant to make up whatever deficiency there may be in the Company's supply of gas. There is too much speculation and uncertainty about the whole business yet; and we should be sorry indeed to see any gas company ultimate sufferers through what may appear on the surface to-day to be a tempting offer—that is to say, tempting if the competition in products other than gas is kept out of sight.

One other matter, upon which there may be an expression of satisfaction is that this extremely speculative undertaking only secured half the capital for which the Directors asked the public. The confidence of the public in the Company is not to be measured by the fact that the Company consists of 3500 shareholders; for there is no information yet as to the extent of their holdings. But there is an item, in the statement presented at the statutory meeting, of £45,000 for underwriting and commission, and £803 for brokerage. The underwriters are reported to have been hard hit; and there seems to be justification for the report. However that may be, in the public interest three-quarters of a million of money is better than the one-and-a-half millions sought for, with which the Board could speculate to ascertain whether "Coalite" is likely to be a veritable gold mine for the investors in it. A unit of plant is to be started at Barking in November. What the unit will consist of has not been made known; but it will be observed that it is to start after people have filled their cellars with coal "at lowest summer prices." To secure a share in the coming winter's business, the "Coalite" Directors had better try to contract at once with a number of gas undertakings in the Kingdom to carbonize a quantity of coal for them at low temperatures and short-period charges. The hope was expressed by the Chairman that every shareholder present at the meeting would, twelve months hence, be very glad he or she had invested money in "Coalite." We shall see.

The Franco-British Exhibition.

The moving spirits in the matter of a Gas Section for the Franco-British Exhibition are beginning their work in the wrong place. The question of the formation of a Committee is in hand; but we venture to think the first step should have been to ascertain the views on the matter of the Councils of the Institution of Gas Engineers and of the Society of British Gas Industries. If we are not mistaken, the very existence of these two bodies has been ignored. Let us suggest with all sincerity that, before asking gentlemen to join a Committee to essay the task of organizing a Gas Section for Imre Karalfy's exhibition at Shepherd's Bush, the plummet should be dropped, and the depths of success or otherwise be sounded; for no gentleman connected with the gas industry can desire his name to be publicly associated with an Exhibition Committee who might—we do not say would—have a failure to record. In the electrical industry, the good offices of the Institution of Electrical Engineers were invoked at the very outset of the movement for the organization of an engineering section at the Exhibition. Why it has not been so in the case of the gas profession's chief organization, together with the Society of British Gas Industries, we are at a loss to understand. It must be said, however, that though the Institution of Electrical Engineers promised to do what they could, the idea seems to be falling very flat indeed in the electrical manufacturing world.

There are several considerations which should be thoroughly weighed before the scheme for a Gas Section is further prosecuted; but here we will only mention three. In the first place, it is absolutely useless to be a unit in a heterogeneous exhibition of the sort that will be held at Shepherd's Bush, the primary object of which exhibition is not the advancement of industry, but the enrichment of the promoters. Good and lavish entertainment will no doubt be found there. That is what people will go to the exhibition for; and, going there for that purpose, they will not be particularly thankful though never had such a collection of gas appliances and plant been made before. In the second place, the manufacturers will not regard it as a good speculation to spend money for space in such a show; and for space which will have to be occupied by goods and attendants for several months. In the third place, these frequently recurring demands on the gas plant and appliance makers will be to the industry's disadvantage in future. The day will come when we must have another special Gas Exhibition on a scale equal to—perhaps larger than—the one at Earl's Court. The Earl's Court Exhibition did more good for the gas industry than would do any mixing of the industry with the crowd at Shepherd's Bush. We need not labour the matter; but this may be added—the fortnight that has elapsed since reference was last made to the subject has hardened our confidence that from the manufacturers the proposal will receive a cool welcome, and without the manufacturers, we ask in all friendly spirit, what is the good of a Committee?

The Position of Elective Auditors.

From time to time the usefulness or otherwise of elective auditors has been a subject productive of much argument in different quarters; but whatever may be the conclusion arrived at on this point, it must be admitted that the reports of these gentlemen have frequently had a most enlivening effect on the municipal affairs of the towns concerned. Sometimes they have had reference to deputation expenses and to the cost of official outings; while at others matters connected with the public work of the town have been questioned. At the present moment, Widnes is the scene of an elective auditor controversy, which has been brought into being by a discussion in the Town Council on the question of fees; the accounts sent in by the two Auditors amounting to thirty guineas—twenty guineas for one, and ten guineas for the other. The Mayor, who remarked that he had been requested to bring the matter to the notice of the members, stated that since 1901 the fees had gone up from sixteen guineas to thirty guineas, for what was not an audit. "It was," he said, "a matter of poking into expenditure, and bringing up to the public gaze any nice tit-bits." The Committee had nothing to hide; but they thought the charges, which worked out at two guineas a day, were excessive. Subsequently, the gentleman who sent in the account for twenty guineas allowed himself to be interviewed by the representative of a local paper, to whom he explained that ten days was none too much in which to complete his audit, and that the Public Health Act of 1875, section 246, directed the payment to each elective auditor of a reasonable remuneration—such remuneration not being less than two guineas per day for every day in which they were employed in auditing the accounts of a council as an urban sanitary authority. He contended the duties of a professional auditor were totally different from those of an elective auditor. A council might pass accounts which were illegal; and it was not the business of the professional auditor to question the payment, or to criticize expenditure, or to point out any unauthorized, illegal, or wasteful outlay of money. That he regards it as the duty of an elective auditor to question (if he thinks necessary) business transactions of the Council whose accounts he is appointed to investigate, he has proved by communicating with the Local Government Board regarding an over draft which he is of opinion has turned out to be a very unfortunate affair for the ratepayers.

District Council Finances.

The accounts of the 818 urban district councils which are noticed this week present many similar features to those of the 324 boroughs (outside the Metropolis) which were dealt with in last Tuesday's issue. But, of course, the figures are on a smaller scale. The total amount of loans outstanding at the end of the year 1904-5, for instance, in the case of the district councils amounted to £33,651,601, as compared with £232,244,589 for the borough councils; and whereas in the latter case water-works provided by far the largest individual item, this honour belongs, in the district council accounts, to sewerage and sewage disposal works—responsible for 24·8 per cent. of the outstanding debt. Water-works come next with 16 per cent.; and then follow gas-works

with 10·3 per cent.; while electric lighting figures at 6·2 per cent. The "reproductive" undertakings and works of private improvement in the aggregate represent no less than £13,441,133, or 39·9 per cent., of the total debt. Of course, as with boroughs, education figures largely in the urban district council accounts; the outstanding loans under this head (£3,359,315) being, as a matter of fact, practically the same as those for gas-works (£3,478,011). In all calculations, therefore, the education charges must be borne in mind. But putting these aside altogether, the outstanding loans of the district councils have increased during the four years 1900-1 to 1904-5 by no less than 31·9 per cent.—from £23,064,280 to £30,417,648. The branches of municipal enterprise which have been most largely responsible for this increase are electric lighting and tramways and light railways; the figures for electric lighting having gone up from £758,422 to £2,088,441. From the point of view of the councils, the financial aspect of affairs would appear to be satisfactory; for in the four years named the receipts (excluding education and loans) have increased by 26 per cent., and the expenditure by 25 per cent. So far as the average rate in the pound raised by rates (other than for purposes of education) is concerned, there does not in this time seem to have been very much fluctuation; the figure having ranged between 3s. 3·25d. in 1904-5 and 3s. 1·9d. in 1900-1 on the total assessable value for these purposes. But a different aspect is placed on the matter when it is noticed that during 1904-5 a sum was raised by the councils, by means of rates, for elementary education, representing 1s. 1·5d. in the pound calculated on the assessable value for poor rate of the districts in which the amount was raised. The Blue-Book shows that in the four years mentioned there has been an increase of 62·5 per cent. in the receipts from the most important "reproductive" undertakings (gas-works, water-works, electric lighting, tramways and light railways, and markets), accompanied, of course, by a considerable growth in expenditure.

The Withdrawal of Tenders.

A matter which is of some importance to local authorities generally has lately been agitating the members of the Hythe Town Council, who have been put to some delay in the execution of work they require done by the refusal of a firm to carry out a contract after their tender had been accepted. The contract in question was for the laying of some water-mains; and when the draft was sent to the successful tenderers some time ago, a considerable amount of correspondence ensued between them and the Town Clerk, the upshot of which was that the firm declined to take the contract. The question then arose as to whether the Council had any remedy against the firm for the expense to which they had been put; and to this the Town Clerk replied that he did not think it was any use to try and enforce the contract to begin with. He suggested an application to the next lowest tenderers, and said that if they were not willing to execute the work at the price named, it would be a question whether the Council would not have a remedy against the first firm. He pointed out that the form of tender they signed was one in which they undertook to execute the contract. In answer to a question, he said this form was not stamped; and he added that he very much doubted whether he could advise the Council to bring an action. One member thought that the Council had been very badly treated, for the firm had declined the contract after two months' delay, and had lost £240 to the ratepayers. He therefore proposed that a strong letter should be sent to them, stating that the Council would take steps to place the contract elsewhere, and would consider whether they had not some remedy. He said he should be prepared to support a proposal that the matter should be laid before Counsel for the purpose of obtaining an opinion as to whether something could not be done; for he thought it quite time, after the trouble they had been put to, that they should show the contractors that they could not play "fast and loose" with local bodies. It was agreed that a letter in the form suggested should be sent to the firm; the Mayor, who seconded the resolution, remarking that the facts of the matter had been staring the firm in the face ever since they signed the tender. If it is the case that all the conditions of the contract were made perfectly clear at the time the tenders were asked, it certainly seems natural that the Council should feel somewhat aggrieved at the delay which has taken place. Meanwhile, it has been decided, as a way out of the difficulty, to accept the next lowest tender.

THE NEW DEPARTMENT AT LEEDS UNIVERSITY.

The Stipend of the Professor of Fuel.

It is to be feared the letter from Sir George Livesey and the editorial reference to it ("Journal" for Sept. 10), respecting his proposal that the gas industry should show its interest in the new branch of work at the Leeds University by providing annually the stipend attaching to the Professorship of Fuel was published at an inopportune time—that is to say, during the holiday season, and during a period when Board and Committee meetings have been postponed. But now Boards and Committees will be re-assembling and resuming their work; and we ask that the matter may be brought to their notice. Full information may be obtained by referring to pp. 677, 681 of our issue for Sept. 10. The total annual sum required is only £500; and towards this the following promises of contribution have been received.

ANNUAL SUBSCRIPTIONS PROMISED.

Leeds Corporation Gas Committee . . .	£100 0 0
Gaslight and Coke Company	100 0 0
South Metropolitan Gas Company . . .	100 0 0
South Suburban Gas Company.	20 0 0
Mr. John Holliday (East Hull Gas Company) .	3 3 0
	£323 3 0

It will be seen from these figures that the promise of an annual sum of less than £200 is all that is required now.

The Institute of Sanitary Engineers held their opening sessional meeting on Monday of last week at the Holborn Restaurant, when the President (Mr. Baldwin Latham) held a reception, and subsequently delivered an address on the importance of the study of subjects associated with sanitary engineering. A matter which he strongly recommended for careful investigation was the question of lead poisoning in relation to the water supply of towns.

A Melbourne Appointment.—Mr. P. C. Holmes Hunt's many friends on this side will be pleased to hear that his year as Acting Engineer of the Metropolitan Gas Company of Melbourne having expired, the Board have appointed him Engineer to the Company. The appointment, it may be mentioned, was accompanied by a very gratifying expression of the Board's appreciation of the zeal, earnestness, and enthusiasm he had thrown into the work. It will be remembered that Mr. Hunt was appointed Assistant-Engineer to the Company in 1902; and last year he was raised to the position of Acting-Engineer, with a view to the confirmation later on which has now been made.

Book-Keeping Down to Date.—The rapidity with which we receive succeeding editions of this small but useful book, by Mr. Andrew Munro, F.C.I.S., is the best possible testimony to the favour which has been accorded to it. The work (which has already found its way into numerous gas offices) has reached its fourth edition; and it is only a little more than twelve months since the issue of the third edition had to be recorded. In view of what has on previous occasions been said of the book in the pages of the "Journal," it is only necessary now to say that it has been revised and enlarged, and is published by Mr. Effingham Wilson, at the price of 2s. 6d. net.

North of England Gas Managers' Association.—The sixty-first half-yearly general meeting of the Association will take place at the George Hotel, Harrogate, on Saturday, the 5th prox., under the presidency of Mr. H. Wilkinson, who will deliver his Inaugural Address. There will also be a paper by Mr. J. C. Angus, of York, on the "Comparative Development of Gas and Electricity as Illuminants." Should the weather permit, a drive on a motor char-a-banc is projected, and a visit to the light railway of the Harrogate Gas Company, the cutting of the first sod in connection with which, by Mr. F. Barber, the Chairman, was recorded in the "Journal" for May 14 (p. 473). Subsequently, by invitation of the Chairman and Directors of the Gas Company, the members will lunch at the George Hotel.

Leeds University and Gas Heating Research.—It will doubtless be remembered that, when referring in the "Journal" for July 16 (p. 152) to the subject of gas engineering at the Leeds University, it was stated that arrangements were under consideration whereby the Institution of Gas Engineers would be able to carry out a scheme of technical research work in connection with the University, under the direction of a Joint Research Committee, consisting of representatives both of the industry and the University staff. Attention is called to the matter here, for the purpose of mentioning an advertisement in to-day's issue, stating that an experienced Research Chemist is required at the University, to undertake an investigation on the economic and hygienic aspects of heating by coal gas, under the direction of a Joint Committee representing the Institution of Gas Engineers and the University. Applications will be received up to the 3rd prox.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 849.)

BUSINESS on the Stock Exchange last week, as in a good many previous weeks, chopped and changed and had its ups and downs. But, unlike its immediate predecessor, which began with a spurt and ended very tired, this time got over its sickness in the earlier half and finished up much better. Of course, animation throughout was much subdued, and things in general were on a holiday scale. The opening was very dull. Consols were steady at first, but afterwards drooped in view of gold going abroad. Home Rails continued a prey to bears, aided by perfervid utterances of the less informed Press, and letters from parliamentarians who had perforce to keep an eye on the Labour vote. Tuesday's tone was rather weaker and much more sensitive, though one or two lines were steadied by special circumstances. Wednesday was almost lifeless; the situation being intensified by a Jewish holiday. Thursday showed no well marked mood beyond being generally listless. There was, however, some demand for Consols, which put them up ¼. Friday took a line of its own; and instead of the usual realizations on that day, the tone was brighter and firmer. Some good investment buying put Consols up; and even Home Rails were a bit better on bear closing. The improvement was fairly maintained on Saturday; and Consols closed ¼ higher. The Money Market exhibited extreme ease; the supply being superabundant to meet all demands. Discount rates were rather hard at first, consequent on gold movements; but they relaxed later on. Business in the Gas Market was a shade more active than the previous week; and the tone was equally firm—all the few changes in quotation being for the better. In Gaslight and Coke issues, the ordinary was very quiet until quite the end of the week. Prices were rather better and very close—ranging only within the limits of 94-94¾. Not much was done in secured issues. The maximum changed hands at 87 and 87½; the preference at 105½ and 106 (a rise of 1 in the quotation); and the debenture at 82 and 82¾. South Metropolitan was more dealt in; but prices were scarcely so good as the week before, varying from 119¾ to 120¼. Commercials were quiet at 102¼ and 102¾ for the 4 per cent., 99 for the 3½ per cent., and 81 and 81½ for the debenture. In the Suburban and Provincial group, Bournemouth "A" was done at 28½, ditto "B" at 17 (a fractional rise in each), Brighton original at 223, Bromley "B" at 88½ and 89, South Suburban at 115, ditto preference at 117½ free, Tottenham "B" at 102½, and West Ham at 102. The Continental Companies were quiet. Imperial marked from 174½ to 176, Union 112, European fully-paid 22⅝, and Tuscan 10 1/16. Among the undertakings of the remoter world, Buenos Ayres was done at 10 15/16, ditto debenture at 93½, Cape Town debenture at 95½, Primitiva at 6 15/16, ditto preference at 5 7/32, ditto debenture at 94⅝, and River Plate at 13⅜ and 13 3/16.

ELECTRIC LIGHTING MEMORANDA.

Electric Wiring Risks—Need for Greater Supervision and Inspection—Property, Life, and Shock Risks—American Fires and their Lessons—Statistics on Tour, and the Result.

IN referring to a suggestion last week by an electrical contemporary, that it would be a good thing if Mr. Lloyd-George would next session turn his attention to bringing up to date the general legislation affecting electricity supply, we expressed the hope that the President of the Board of Trade, if he devoted time and mind to this useful object, would do something towards eliminating the inequality of the law as between gas and electricity supply, and protecting the electricity consumer, by instituting penalty testing for electricity supply, and compulsory testing and stamping of electricity meters. If he takes the matter up, perhaps beforehand he will also read an article on "Electric Wiring Risks," by Mr. Frank Broadbent, M.Inst.E.E., which has been published in the "Electrical Review," consider it in conjunction with the *magnum opus* of the Institution of Electrical Engineers, comprising the mighty array of rules which are necessary in electric wiring and installation work, together with the efforts of the Home Office and certain fire offices in the same direction, and see whether it would not be advisable in the public interest for all this provision for protection to have compulsory supervision and inspection attached to it. Mr. Broadbent is very emphatic upon the point as to "the need for careful supervision and inspection of electrical work" being "more than ever necessary." And he asserts that "it is doubtful if the technical staffs, either of the Home Office or Insurance Companies, are sufficient to give that amount of inspection which is necessary." Again, later on, he remarks: "Nowadays the use of electricity and flexible cords is so general as to have become a commonplace, so that there is more need than formerly to make electrical apparatus as safe as possible, both as regards fire risk and risk to life." But it is certain there will not be that careful supervision and inspection—not only of first installations but extensions—that Mr. Broadbent says is so necessary till there is compulsion. In America, the tendency is in the direction of appointing an electrical inspector by the city authorities; and yet in towns where this practice is adopted "electrical fires and dangerous shocks are not unknown." However, this question of supervision and inspection is another point for Mr. Lloyd-George to look into.

It would appear in reading Mr. Broadbent's article that in America more attention is paid to the protection of property than to the safeguarding of life. But opinion there is inclining to the view that this is not as things should be, and that there should be greater protection not only against the risk to human life from fire, but against shock, which may possibly prove fatal. In the form of lamp socket used in America for electric incandescent lamps, there is danger; for a person touching it may receive "a severe and possibly a fatal shock." In this country, the bayonet holder is almost universally used; and the danger of receiving anything like a fatal shock from this is very remote indeed. But still there are on the market, as Mr. Broadbent mentions, patterns of key-holders from which nasty shocks can be obtained; and it is wise, as is done in the rules of the Institution of Electrical Engineers, to prohibit their use on circuits carrying pressures greater than 250 volts. This point as to voltage reminds that in the United States 110 volt parallel systems, or three-wire systems with 220 volts across the outers, are still quite common; but a voltage of 200 to 250 is looked upon as a dangerous one. It was shown in the "Memoranda" quite recently that there had been in this country several instances of death caused by electricity supplied at this common voltage. Mr. Broadbent considers that electrical work carried out by firms of standing offers very small risk, from the fire hazard point of view. But we would point out that the firms of standing are generally the firms who charge most for their work; and that a very large proportion of installation work finds its way into the hands of firms who cut prices and are expert at scamping. Among them lies the greater danger, and the reason for the greater need for compulsory supervision and inspection. It is freely admitted by Mr. Broadbent that the increasing use of motors on systems carrying pressures of 400 volts and over makes it more than ever requisite that every precaution should be taken to prevent shocks being sustained by people——many of whom are unskilled—who have the handling of electrical apparatus.

An interesting part of Mr. Broadbent's article is a digest of a report by the Electrical Bureau of the National Board of Underwriters. From the report covering the electrical fires from Jan. 10 to April 19, it appears that 141 fires were due either to defective installations or to careless handling of electrical apparatus. Of these, 21 fires were caused by high-tension lines falling on telephone and lighting circuits. In this country, fires have also been known to be caused—though Mr. Broadbent says the cases are rare—by trolley wires falling across, and making contact with, telephone wires. Lately, in this country, the question of overhead wiring, on account of cheapness of installation, has been revived; but simultaneously, in Canada and the United States, the danger arising from the use of overhead wires in cities is causing considerable concern. According to the "Montreal Star," the Underwriters' Association believe that some of the recent disastrous fires in the city have been due to the general use of overhead wires; and they have called upon the city authorities to construct underground conduits as soon as possible, so that all wires may be buried. Regarding other causes of electrical fires. In the three months, 18 of the fires were produced by the grounding of lighting and motor circuits; and short-circuits on interior installations occasioned 32 fires. Fires caused by electric flat-irons and movable picture machines are not separated; the total being nine. "One of the risks of electric flat-irons is that they overheat when not in use. But in some works, the stands are provided with switches which automatically cut off the current from the iron when it is laid down." One of the largest fires reported—resulting in the loss of £250,000—was due to carelessness in the use of an electric flat-iron. It is explained that the lighting company for some reason shut off the current from the building, and later in the day turned it on again. In the meantime, a maid had attempted to use an electric flat-iron, and finding the current off left the iron, switched on, lying on inflammable material. It would be impossible, says Mr. Broadbent, to prevent such an accident as this, except by providing the circuits with no-voltage release switches. However, the risk is big for such an insignificant service as is rendered by an electric flat-iron.

But to proceed. Fuses blowing caused six fires, electric motors and rheostats caused between them 13 fires, electric incandescent and arc lamps five fires, and electric bed-warmers two fires. One case is that of an old lady who used an electric bed-warmer, which she was supposed to turn off when it became hot; but as she was too feeble to reach the socket, the warmer set fire to the bed. Another fire (which caused a loss of £6000) was due to a motor-starter being left in the starting position, instead of being thrown over to the running position. In the concluding part of his article, the much debated question of the use of flexible cords is treated by Mr. Broadbent; the attack upon them evidently being prompted by a case in which a long flexible cord of a pendant lamp was twisted round a steam-pipe, which resulted in a short-circuit, and set fire to the insulation and to other goods in the neighbourhood. Mr. Broadbent regards these flexible wires as the "most risky part of any installation put up according to approved methods." It is indeed "as risky to use unprotected flexible wires for electrical apparatus, more particularly for portable apparatus, as to use rubber pipe for portable gas apparatus." Condemned by all fire offices, the time will, he thinks, probably come when unprotected flexible cord for portable apparatus will

also be prohibited. Still, after all is said, our electrical competitors continue to plead with householders for their custom on the ground that there never was anything safer introduced into a house than electric lighting and heating. Never has there been anything introduced more insidious in its action, nor anything more capable of hiding the destructive side of its character. Fortunately, in this, it has not always succeeded.

While upon the subject of electrical accidents, an interesting instance of the circuitous course sometimes taken by news is afforded by a paragraph published in the "Electrician" less than a fortnight since. It was headed "Accidents Caused in Germany by Various Systems of Lighting." It commences with: "L'Industrie Electrique gives some interesting statistics of the accidents caused by various illuminants during 1906 in Germany." The figures published were first contributed by Herr Schäfer to the "Journal für Gasbeleuchtung," were published by us and commented upon on July 16 last (pp. 148, 182), have been published by "L'Industrie Electrique," and have now returned to England, and found a place in the "Electrician." The circular tour taken by these figures has not improved matters. In our electrical contemporary, the first column is headed "Nature of Accidents;" and the figures are arranged against the words "slight," "serious," "fatal." Now if the column had been headed "Number of," and the figures set against the words "Accidents," "Men injured," "Men killed" (see *ante* p. 182), the figures would have had a different and correct value. It is well to have data of this kind published accurately—particularly when we read, "the following table only takes into account accidents which happened to people." Published in the form given by the "Electrician" we have 302 accidents by gas which caused human sacrifice and distress, and 123 by electricity; whereas as a matter of fact there were only 112 accidents by gas and 42 by electricity. In the 112 gas accidents 149 men were injured, 41 fatally. In the 42 electrical accidents, 46 men were injured, 35 fatally. Although the accidents caused by gas were more numerous owing to the considerably greater use of gas than electricity, there were only 41 fatalities compared with 35 in the case of electricity with its much smaller use.

It was only in last week's "Memoranda" that reference was made, and this was not the first time, to the folly of committing places of public assembly, such as churches, to a system of lighting that has become notorious for its want of reliability, and more especially without making provision for an alternative system of illumination. A great responsibility rests upon those who put such trust in electric current for lighting that they adopt it solely for the illumination of churches and other public buildings. We are adjured not to put our trust in princes; but certainly some of the modern ones appear to be more worthy of confidence than the electric light. The admonition therefore appears to require a little qualification and extension to make it apply to the modern conditions of life. On the occasion of the harvest thanksgiving service at the Old Windsor Parish Church one night last week, the electric light collapsed, and the sacred edifice was plunged in total darkness. Report states that the words of the Psalmist, "Thou makest darkness and it is night," were being chanted. We cannot vouch for the truth of the statement. But if true the words were appropriate to the incident. Fortunately there was no panic; and the choir manfully stuck to duty. The spectacle of the Church begging for candles from neighbours was witnessed; and under difficulties the service was continued.

AN INDICTMENT OF MUNICIPAL TRADING.

We publish in another column an abstract of the remarkable report which Mr. Hubert Leicester, Chartered Accountant, has presented to the Barnstaple Corporation on the financial position of their electricity undertaking after some five years' working. Frequent reference has been made in the "Journal" to the difficulties by which the Corporation have been beset in the conduct of this business, and the lessons they seem to offer to other local authorities who may be tempted to engage in similar speculations in the hope of serving the interests of their constituents, the ratepayers. The fact which has been most conspicuous in the carrying on of this business is that, while the ratepayers have been mulcted in ever-increasing charges for the lighting of the streets, the electricity undertaking has failed to make a profit, and, on the contrary, has shown from its inception a steadily increasing adverse balance. This is a condition of things not confined to Barnstaple. Mr. Leicester's report is, however, a complete vindication of the critics of the administration of the town, who have insisted again and again that municipal trading as carried on there is much more likely to lead to bankruptcy than to affluence.

Although the report refers particularly to the Barnstaple accounts, and deals especially with the state of things existing in that town, its principles have a far wider application. Mr. Leicester speaks with authority in such matters. As he himself says, his conclusions are "the result of much consideration and experience." He has been Mayor of Worcester—a position in which he could not fail to appreciate the troubles of a municipality saddled with the burden of an unremunerative electricity undertaking. But his interest in such matters dates back much longer than his selection for high municipal office. Many years ago Mr. Leicester published a remarkable paper, in which he pointed out that the policy of borrowing money for all sorts of municipal purposes is attended with grave risks, and that, so far as it aims at "placing the burden on posterity," it is a fallacy, because the present generation of ratepayers is punished equally with those who are to follow it. Mr. Leicester has not succeeded in inducing local authorities (not even the important one over which he recently presided as Mayor) to adopt his views on cash payment—principally, no doubt, for the reason that everyone of them is burdened with debt, and it is easier to add to debt than to even temporarily increase the current rates for the sake of avoiding payment of interest in future. This, however, is rather beside the mark. It only shows that, when he refers to such subjects as the proper division between capital and revenue expenditure and the depreciation of the assets of a municipality, Mr. Leicester does not speak as a novice, but as one well versed, in such matters as these.

The two things which stand out most conspicuously in the revelation he has made to the Barnstaple Corporation are the little revenue which the electricity works have succeeded in earning, apart from what is received indirectly from the rates for public lighting, and the absence of any provision for depreciation. Familiar as we are with the manner in which the revenue of municipal electricity works is assisted, it is a little startling to find that of the total sum of £13,445 that the Barnstaple electric undertaking has received from the sale of current in the five years of its history, no less than £6330, or 47 per cent., has been derived from public lighting. It is now easy to understand the constantly reiterated complaints about the cost of public lighting at Barnstaple. With the burden of an undertaking which has cost £31,165, and a population which has shown no anxiety to pay extravagantly for its private lighting in order to meet the heavy charges for interest and sinking fund, the Corporation have been driven to make a revenue of a sort by charging a good round sum for public lighting. It is a common device. There are few, if any, municipalities owning electricity works which do not make the rates contribute in this manner to the support of the undertaking. Sometimes they are able divide the burden with a tramway business; but in one way or another, whether electricity works are "profitable" or not, the ratepayers are liberal, though probably unconscious, contributors to their support. An interesting little sidelight on the value of ordinary accounts as a true criterion of municipal trading is afforded in an observation of Mr. Leicester with reference to certain stock on hand in connection with the public lamps. This is rightly taken into the account as an asset, and if used upon public lighting without making any further charge against the Corporation, it will enable the department to show a small profit on this branch of its business. Mr. Leicester, however, foresees that "there is the danger that when this stock is used in repair and maintenance of public lamps it may again be charged to the Corporation," to the consequent increase of the "profit."

With regard to depreciation, Mr. Leicester's figures do not differ materially from those of other people who have given attention to the subject, and certainly do not err on the side of an excessive allowance. In proposing to write off 10 per cent. for machinery, he practically assumes that everything about the undertaking is to be worn out, and that nothing will be scrapped for obsolescence. This is a moderate estimate, and taken in connection with other items, such as 2 per cent. for buildings and 4 per cent. for mains, no electrical engineer can say that it is more than prudence would suggest. But in this matter there is a great gulf fixed between theory and practice—between what is desirable and what is actually done. In Barnstaple, the sum of £2170 ought year by year to be laid by to provide for depreciation on the scale which is necessary if the plant is to be replaced as it is worn out. Instead of this, all that the Corporation are doing is to set aside a sum equal to £676 per annum, with which to repay within the statutory period the debts they have incurred on account of the electricity undertaking. Mr. Leicester says, truly enough, "it is not the custom of many electricity undertakings to make any provision for depreciation other than that required by the Local Government Board." The fact that it is not the custom to follow the right course in this matter is doubtless due to the circumstance that most corporations running electricity works are in the same position as that at Barnstaple, and have no money to spare.

What position they will be in when the day comes for the renewal of worn-out plant, the original cost of which has not been discharged, will depend largely upon the view taken by the Local Government Board. The Board may allow "one asset to represent two loans," which would obviously be a very simple solution of the difficulty from the Corporation's standpoint. On the other hand, the Board may insist—as in the interest of the loanholders it should—on everything in the nature of a replacement being treated as a renewal and charged to revenue. If it should uniformly take this course, there are very unpleasant times in store for the ratepayers, not only of Barnstaple but of many other towns, carrying on trading undertakings on municipal rather than business lines. We shall await with some curiosity the decision of the Barnstaple Town Council upon the recommendations of the Accountant whose verdict they have invited. It may be the Corporation will devise means by which they will be able to pay off the adverse balance on the revenue account of their unfortunate undertaking, and at the same time make that provision for the

future which will avoid the possibility—which Mr. Leicester fears—of "a heavy call upon the rates each year to meet the deficiency resulting from increased interest and instalment of loans." How it is to be done we do not know. No doubt a heavy call upon the rates now would avoid the necessity of a still greater call later; but the Barnstaple Council will have made no slight approach to municipal heroism if they pay off the deficiency which they have allowed to accumulate as the result of their five years' trading and make provision for preventing any further loss by charging such a price for current as will enable the works to pay their way. In the matter of depreciation, we anticipate that the Corporation will be content, if they are allowed, to let things slide as they have done in the past.

LOCAL INCOME AND EXPENDITURE.

Finances of Urban District Councils.

REFERENCE is again made this week to Part V. of the Annual Local Taxation Returns, for the purpose of noticing some of the figures therein contained which relate to the finances of the urban district councils. In our last issue, the portion devoted to the affairs of the councils of boroughs was dealt with; and it was then pointed out (and it is a fact which must be carefully borne in mind) that the statistics furnished by the Blue-Book are for the year 1904-5.

The number of urban district councils in England and Wales, for districts other than boroughs, dealt with in the report is 818. This shows an increase of five as compared with the previous year—nine urban districts having been formed during 1904-5, while four which appeared previously are not included owing to the fact that they were incorporated in 1903-4. It may be mentioned that there will be seven more urban districts to remove from the next Blue-Book—one having been incorporated and six added to boroughs during the year now under review. It is pointed out in the report that the financial transactions of urban district councils resemble in many respects those of the borough councils, although they are generally speaking on a smaller scale. As in the case of town councils, a considerable portion of the transactions recorded relates to gas, electric lighting, water, market, and tramway undertakings, the "reproductive" nature of which, of course, has to be borne in mind in considering the effect of the outlay on taxation. The receipts of the urban district councils (not being borough councils), excluding those from loans, during the year 1904-5 amounted to £10,476,119, including £1,388,852 on account of elementary education. Deducting the latter item, the total was £9,087,267, compared with £8,880,437 in the preceding year. These receipts included sums received from County Councils under the provisions of the Local Government Act, 1888, and also grants under the Agricultural Rates Act, 1896. The latter Act, however, does not apply to general district rates, which, in the case of the urban district councils produced 86 per cent. (£4,986,545) of the total raised by rates (£5,791,613), so that the amount of the grants is small in comparison with that of the total income from rates. Among the other receipts were: Gas-works, £843,024; water-works, £794,092; electric light undertakings, £216,927; and tramways and light railways, £142,413. So far as the compilers of the Blue-Book could ascertain from the returns made, the receipts in respect of gas-works included £628,110 from gas-rentals, and £184,502 from sales of residual products. The receipts in respect of the water-works included £453,025 from water rates, rents, or charges for domestic purposes within the respective districts of the councils owning the water-works. They also included sums of £72,830 and £79,150 received by the Urban District Councils of Enfield and Tottenham for the transfer of their undertakings to the Metropolitan Water Board. The amount raised during the year 1904-5 by means of public rates accounts for 55 per cent., while the receipts from reproductive undertakings (together with those in respect of private improvement works) represent rather more than 26·5 per cent. of the total receipts.

The total expenditure of the councils in the twelve months under review (excluding that defrayed out of loans) was £10,361,206. Deducting the outlay on elementary education, the expenditure was £8,969,257, as compared with £8,761,947 in the preceding year (1903-4). The increase was thus £207,310; and it occurred chiefly in connection with the loan charges—principal repaid, interest, and payments to sinking funds and redemption funds—and in items relating to public works. The increase in respect of the loan charges was £74,732. Among the expenditure was £1,720,541 on public roads, &c.; £1,284,875 on education; £568,723 on gas-works; £477,756 on public lighting (including £77,026 for lighting by electricity); £470,654 on sewerage and sewage disposal works; £375,476 on water-works; £131,846 on tramways and light railways; £102,687 on electric lighting (not being public electric lighting); and £2,670,245 on repayment of principal of loans (otherwise than out of sinking funds or redemption funds), payments to sinking funds, and interest on loans. Of the principal and interest so repaid, and allocations to sinking funds, £218,626 was on account of gas-works, £417,302 of water-works, £124,093 of electric lighting, and £63,180 of tramways and light railways. The aggregate length of main roads maintained and repaired by the councils at the commencement of the year 1904-5 was 2405 miles; and the outlay under this head during the year amounted to £483,735, or at the rate of £201 per mile. The total length of the roads other than main roads maintained by the councils was 11,315 miles; the expenditure being £910,105, or an average cost of £80 per mile.

The expenditure out of loans (including certain sums spent in anticipation of loans) during 1904-5 amounted to £3,958,592. Of this, £256,209 was on gas-works, £357,050 on water-works, £513,651 on electric lighting, £608,846 on tramways and light railways, and £646,652 on sewerage and sewage disposal works. The total expenditure out of loans in 1904-5, for purposes other than elementary education, was greater than that of 1903-4 by £81,962. Considerable decreases are shown under the headings of water-works and sewerage and sewage disposal works; but, on the other hand, those of gas-works and tramways and light railways exhibit a large increase. The total amount of the loans raised was £3,929,137, including the following amounts: Gas-works, £276,865; water-works, £346.790; electric lighting, £409,895; tramways and light railways, £658,991; and sewerage and sewage disposal works, £604,025. The amount of loans raised during the year (excluding moneys borrowed for purposes of elementary education) was less than in 1903-4 by £40,023. The loans in respect of electric lighting, water-works, and sewerage and sewage disposal works were much smaller; while considerable increases are shown in the amounts raised for gas-works and tramways and light railways.

The amount actually repaid during the year in respect of loans (including payments out of sinking and redemption funds) was £1,551,064, excluding unexpended balances of loans applied to repayment of principal. The outstanding loans at the end of the year 1904-5 amounted to £33,651,601. Of this debt, £8,338,475, or 24·8 per cent., was incurred for purposes of sewerage and sewage disposal; £5,386,862, or 16 per cent., for water-works; £3,478,011, or 10·3 per cent., for gas-works; £3,359,315, or 10 per cent., for education; £2,747,780, or 8·2 per cent., for street improvements; £2,088,441, or 6·2 per cent., for electric lighting; and £1,369,729, or 4·1 per cent., for tramways and light railways. The loans outstanding in respect of what are termed the "reproductive" undertakings and works of private improvement, represent a large proportion—£13,441,133, or 39·9 per cent.—of the total debt. The total amount of loans outstanding increased during the year ending March 31, 1905, by £1,235,792; the purposes in respect of which the largest increases took place being tramways and light railways, electric lighting, and gas-works. The amount remaining at the end of the year in sinking and redemption funds for meeting loans that are repayable in this way was £508,997. The sum paid to the funds during the year was £185,273; and the amount taken out of the funds and applied to the repayment of principal was £143,807.

According to the census of 1901, and taking into account the alterations of area since that time, the total population of the 818 urban districts other than boroughs was 7,111,517, including 213,648 in respect of districts which were added to, or became, boroughs during 1904-5. The total assessable value of these districts for the purposes of the general district rates, or other rates out of which the general expenses of the district councils were defrayed, was £31,479,046, including £1,037,562 in respect of the districts which were added to, or became, boroughs during the year. The rates raised by the councils, other than for purposes of elementary education, amounted to £5,148,581, and were equivalent to 3s. 3·25d. in the pound on the total assessable value of the districts for the purposes of such rates. This figure compares with 3s. 2·8d. in 1903-4, 3s. 3·1d. in 1902-3, 3s. 3d. in 1901-2, and 3s. 1·9d. in 1900-1. The total amount raised by means of rates during the year 1904-5 for purposes of elementary education was £643,032—which was equivalent to a rate of 1s. 1·5d. in the pound calculated on the assessable value for poor rate of the districts concerned.

Comparative tables accompanying the returns show that the receipts of urban district councils from all sources except elementary education, but excluding the receipts from loans, increased between 1900-1 and 1904-5 by 26 per cent.; while the total expenditure not defrayed out of loans increased by 25 per cent. The receipts from public rates for purposes other than elementary education (including grants under the Agricultural Rates Act, 1896), which in 1900-1 amounted to £4,307,776 and in 1904-5 to £5,152,791, show an increase of 19·6 per cent. in the four years. The increase between 1903-4 and 1904-5 amounted to £85,197, or 1·7 per cent. Receipts from gas-works, water-works, electric lighting, tramways and light railways, and markets show an increase during the four years of 62·5 per cent.; while the annual expenditure in connection with these undertakings has also grown considerably. The amount of the outstanding loans, for purposes other than elementary education, rose from £23,064,280 at the end of 1900-1 to £30,417,648 at the end of 1904-5—an increase of 31·9 per cent. in the four years. The principal increases in the amounts outstanding in the period named were in respect of loans for electric lighting, tramways and railways, sewerage and sewage disposal works, water-works, gas-works, and street improvements. As regards electric lighting undertakings and tramways and light railways, it is pointed out in the Blue-Book, the increases are specially noticeable; the total amounts of the loans outstanding for these purposes having risen respectively from £758,422 and £160,667 at the end of 1900-1, to £2,088,441 and £1,369,729 at the end of 1904-5.

ENGINEERING AND MACHINERY EXHIBITION.

The Engineering and Machinery Exhibition at Olympia last year was such an unqualified success, that it was determined to hold another this year, of which it was hoped some of the larger engineering firms would avail themselves, to even better demonstrate the progress of British mechanical manufactures during recent years. The determination has been fully justified by the excellent exhibition inaugurated last Thursday by Sir Alex. B. W. Kennedy, LL.D., F.R.S., President of the Institution of Civil Engineers, in the presence of representatives of most of the engineering societies, including one of the Vice-Presidents of the Institution of Gas Engineers (Mr. James W. Helps), the Honorary Secretary (Mr. S. Y. Shoubridge), and the Secretary (Mr. W. T. Dunn). The exhibition this year is on a larger scale than last; but nevertheless, thanks to the energy of the Organizing Managers (Messrs. G. D. Smith and F. W. Bridges), and the hearty co-operation of exhibitors, the great display was well advanced towards completion when the President made his tour of the stands. There was evident gratification on the part of Sir Alexander, who has taken a close personal interest in the preparations, on the completeness and comprehensive character of the display; and his congratulations were of the warmest at the little opening ceremony in the centre of the vast building.

A large part of the exhibition is taken up by machine tools, larger and more varied in character than at the exhibition a year ago. In gas-works, machine tools have acquired an important standing; and their use is ever on the increase. This is one of the results of the daily extending use of mechanically operated plant in such works; and now facilities for promptly attending to breakdowns and doing repair work are of immense importance in the economics of gas-works. Therefore the gas-works engineer finds it more and more essential to keep himself acquainted with all that is modern in the nature of machine and hand tools which may be of service to him. At an exhibition of this kind, he has the latest and the best gathered together for his examination. He will discover on inspection that there have been considerable strides made in the production of all these useful machines, either in new purpose or in greater refinement in the performance of the old. We cannot here enumerate the types of the machines to be seen; but a visit to the exhibition (any time before Oct. 19) will confirm our statement.

It is a very big field that is covered by the exhibition. Attention is also claimed by gas-engines, suction-gas plants, engine indicators, air gas, castings, furnaces, steam pumps and fittings, boilers and their accessories, air-compressors, valves, hand tools, pneumatic tools; and special mention might be made of the Fairbanks Company with their large selection of shop appliances, and of Messrs. Joshua Heap and Co.'s machines for pipe, nut, and bolt work. Casting the eyes along other stands, conveyors are found, scientific instruments for maintaining a strict care over work to ensure economy, gauges, packings and jointings, lubricators, belting, fans and blowers, ventilators, water-meters, and time registers—in fact, there are a thousand-and-one contrivances of interest to the gas engineer and works manager.

Specially referring to certain of the exhibits, Messrs. Crossley Brothers are showing their gas-engines connected up to suction-gas plant; the same with the National Gas-Engine Company, Limited, and Messrs. Richard Hornsby and Sons, Limited. The Fairbanks Company are also showing a 7-horse power gas-engine. Regarding the air-gas systems on view, great claims are, of course, made for them. The Non-Explosive Gas Company (Cox's system) give the information that their gas is composed of 1·4 per cent. of hydrocarbon vapour and 98·6 per cent. of air. A report upon the system has been made by Messrs. C. E. Cassal, F.I.C., and J. Kerr, F.I.C. "As the result of a large number of photometric observations, using an inverted burner, and the small No. 1 mantle recommended," these reporters "have obtained an average illuminating power of 125 standard candles per burner, as against an average illuminating power of 40 standard candles per burner obtained with ordinary gas tested under the same conditions, and with mantles of the same type." The National Air-Gas Company with their apparatus produce a gas composed of 98½ per cent. of air and 1½ per cent. of commercial petrol vapour. The light afforded is stated to be 75 per cent. cheaper than incandescent light with coal gas, but only 93 per cent. cheaper than coal gas used with flat-flame burners. It is obvious that one of these two figures, or both of them, must be wrong. We rather incline to the belief that both are open to question.

Messrs. Alex. Wright and Co. are showing the Simmance-Abady "CO_2 mbustion" recorders, draught gauges, air-meters, fuel feed or fire-feed recorders, calorimeters, pressure-recorders, specific gravity bell, "Flicker" photometer, &c. The Hohmann and Maurer Manufacturing Company are exhibiting thermometers, gauges, hydrometers, improved gas-leakage indicators, &c. Messrs. Sanders, Rehders, and Co. are showing their "Sarco" combustion (CO_2), pressure, and gas-volume recorders, and many other instruments.

Among other exhibitors, we notice the Pulsometer Engineering Company, who are showing the largest and the smallest size of their "Pulsometer" steam-pumps. The small one, which throws 1000 gallons an hour, is only 17 inches high; while the large one, which throws 150,000 gallons, measures 126 inches. An interesting exhibit is that of the Lowca Engineering Company, Limited, who have staged a new and improved method of screening, conveying, and handling all materials by machinery mounted on ball-bearings. Messrs. John Barker and Co., Limited, are forward again with Kennedy's patent machine for bending cold, by hand or power, iron, copper, brass, and steel tubes up to 2 inches. Practical demonstration of the excellent work of this machine is made at the stand. The British Coin-Handling Machine Company are showing their automatic cashiers and silver sorters, which were described not long since in our columns.

A number of lectures have been arranged for during the course of the exhibition; among them being one last Saturday night on "Gas-Engines and Suction-Gas Plant," by Mr. Hal Williams, and next Saturday one on "Sanitation and Ventilation," by Mr. A. E. Battle.

Military music and a café chantant will give each day diversion to the more prosaic duty of inspection of the exhibits.

After the formal opening of the exhibition on Thursday, there was an inaugural luncheon, at which there were a large number of guests. The President was in the chair. Afterwards, there were a few toasts. The one wishing "Success to the Engineering and Machinery Exhibition" was proposed by the Hon. Sir Horace Tozer, Agent-General for Queensland; and response was made by the President. In the course of his remarks, he said he remembered the Great Exhibition of 1851, and most of the exhibitions that had succeeded it. Regarding the present exhibition, representing what it did, it might be considered a large one indeed, and not by any means a small one. There were something like 25 per cent. more exhibitors than last year; and the exhibits he believed weighed between 2500 and 3000 tons, corresponding to an estimated value of something like £100,000. The machinery in motion in the exhibition would, no doubt, have its perennial attraction for the visitors. It covered some of the most modern constructions of electrically-driven tools adapted for special work, and capable of being used at exceptionally high speeds. In fact, if he were to single out any one class of machinery which was particularly well represented in the exhibition, it would be the class of machine tools. The collection was of unusual excellence, embracing, as it did, some fine exhibits not only from the manufacturers of this country, but from the Continent and from America. The Managers of the exhibition last year were able, generously, to hand over £500 to the benevolent funds of the various engineering societies; and they were very handsome and welcome donations. As Chairman of the Benevolent Fund of the Institution of Civil Engineers, he had, therefore, a very personal interest, not only in the technical, but also in the financial success of this exhibition; and he hoped, and, indeed, had no doubt, that this year, as formerly, the success of the exhibition would be sufficiently great to enable the Managers to again help those benevolent funds. The toast of "The Engineering Industries" was proposed by Professor Ewing in a racy speech; and responded to by Mr. T. Hurry Riches, the President of the Institution of Mechanical Engineers.

Lecture on Gas-Engines and Suction-Gas Plants.

The first lecture at the Exhibition was delivered on Saturday evening by Mr. Hal Williams, M.Inst.M.E., Assoc.M.Inst.E.E., on "Gas-Engines and Suction-Gas Plants." Professor Burstall, of Birmingham University, who is well known in connection with the investigations of the Gas Engine Research Committee of the Institution of Mechanical Engineers, was in the chair.

In his opening remarks, the lecturer said that, in addressing an audience composed most largely of engineers, it would not be necessary to attempt to prove the economy of gas-engines and suction-gas plants over other forms of motive power; and therefore they might take it for granted, as already proved over and over again, that suction-gas plants had a heat efficiency of 89 per cent., and that a gas-engine had a heat efficiency in the ordinary way of over 30 per cent. This compared with 72 per cent. in the steam-boiler, and 7 to 10 per cent. in the steam-engine.

Continuing, he referred briefly to two-cycle engines, and went on to deal with the "Otto" cycle horizontal engine, which he stated was, in his opinion, the most satisfactory form of gas-engine yet devised, and the most reliable from the power-user's point of view. Mr. Williams emphasized the necessity of reliability, and pointed out that power is cheap only so far as it is reliable, and that an economical engine with a tendency to stop is a far worse investment than an extravagant engine which keeps the wheels going round. In this connection, he pointed out that, so far as present knowledge of gas-engine design extended, this reliability was to be found in keeping the cylinders of the engines of moderate dimensions, and obtaining increased power by multiplying the number of cylinders rather than by increasing their size. He laid it down that, in his opinion, it was not advisable to have a larger diameter of cylinder than from 21 to 24 inches; the reason being that in large cylinders the expansion produced by the excessive heat of the explosion, which reached 1500° C., introduced difficulties of design which had not yet been satisfactorily overcome. In dealing with governing, Mr. Williams gave preference to engines which were governed by the variable admission of a mixture of constant quality.

The lecturer then proceeded to deal with the cooling of gas-engines, and the temperature at which the water should leave the jackets, and pointed out that it was just as necessary to keep the

water round the jackets as hot as possible in a gas-engine as it was to steam-jacket the cylinders of a steam-engine. He also instanced several methods of re-cooling the jacket-cooling water for use over and over again.

As regards the starting of gas-engines, he advocated the use of compressed air and large receivers. He pointed out that engines up to 150 H.P. could quite easily be started by a starter consisting of a small pump which introduced the first charge of gas and air into the cylinder. He then dealt with various points in connection with the general design of gas-engines, and the materials from which the shaft and connecting-rods should be constructed; stating that, in his opinion, only Siemens-Martin acid steel should be used for these purposes.

In dealing with suction-gas plants, Mr. Williams explained the necessity of designing the plants so that the proper zones were always maintained, and stated that a great deal of the trouble which arose with these plants was due entirely to the ignorance of the operators who were working them, and who had not had explained to them the first principles of gas production.

In conclusion, he referred to Mr. Dugald Clerk's experiments on the specific heat of the products of combustion at high temperatures, and said he felt that the future of the large gas-engine depended on some satisfactory means being obtained of reducing the temperature in the cylinder due to the explosion of the gaseous mixtures.

THE USE OF GAS FOR HEATING PURPOSES.

It will be remembered that in the course of the paper entitled "The True Scope of a Gas-Works," read by Herr Kobbert before the Mannheim meeting of the German Gas Association (see *ante*, p. 96), the speaker expressed the opinion that the proper method to be adopted with the object of converting a gas-works into the true central station for the generation of all the heat required in a neighbourhood was to make a gas of much lower calorific value than is customary at present, and to do everything possible in order to stimulate its consumption in heating stoves and the like. At the close of the paper Dr. Bunte remarked that, having regard to the existing dimensions of distributing systems, and to the class of illuminating burner in use, &c., it was not advisable to diminish the calorific power of gas below some 560 B.Th.U. per cubic foot, and that, therefore, every endeavour should be made to increase the quantity of coke sold for heating purposes. Herr Körting, of Berlin, followed Dr. Bunte on somewhat similar lines; and the gist of his observations may be summarized from the account published in the "Journal für Gasbeleuchtung."

Herr Körting said that it was not desirable to make gas of less calorific intensity than 560 B.Th.U. Such a gas still retained the present characteristic of coal gas of being a high-grade fuel; and yet its manufacture did not involve the retention of the expensive process necessary to confer upon it a high illuminating power when consumed in non-incandescent burners. The question for the future was, therefore, how best such a gas could be made, and what alterations in the manufacturing process were requisite, in view of the fact that machinery was being increasingly used on gas-works, and that the mechanical energy required must come from the consumption of coke either under steam-boilers or in gas producers. The manner in which the manufacture of gas had altered of late was best shown by the following table, where the quantity of gas and of coke made, and the amount of coke consumed for various purposes on the works, were indicated per unit of coal carbonized. On examining the figures, it would be seen that when the retorts were fired direct, the quantity of coke consumed in the furnaces was large, while but little was used for the production of mechanical energy. The introduction of regenerative furnaces greatly reduced the amount of coke consumed. When the conditions of manufacture were so changed that a gas of 560 B.Th.U. was made in retorts with regenerative settings (drawing and charging machines being employed), the retorts had to be raised in temperature and the charges decreased. In this manner less coke was left for sale, because more was consumed. When inclined retorts were adopted, gas of the calorific power mentioned could hardly be produced owing to the high speed with which the gas left the carbonizing vessels, unless the process of auto-carburation was adopted. This, again, in comparison with the ordinary regenerative settings referred to in Column 2 of the table, increased the amount of coke consumed and reduced the quantity available for sale. The final stage of the evolution consisted in the introduction of vertical retorts, which once again, compared with Column 2, involved an increase in the consumption and a decrease in the saleable coke. In fact, through the adoption of improved methods of working, the amount of coke left available for sale had, since the days of horizontal retorts fired with regenerative furnaces, diminished per unit of coal carbonized in the ratio 18 : 13.

Herr Körting went on to say that appliances for warming a whole building by the combustion of coke in one furnace were certainly very beneficial to the gas industry, inasmuch as they enabled gas engineers to compete with brown coal briquettes and cheap coal as providers of heat. Indeed, the coal merchants were looking forward to a day when Berlin would not be able to make as much coke as it used in the production of heat, although the annual consumption of gas there was approximately 4600 cubic feet per head of the population. In spite of the competition of electricity, members of the upper middle class were still the best customers of the gas trade; and they would become even larger consumers when the true advantages of the gas-fire were more generally appreciated. In one of the best residential suburbs of Berlin, the consumption of gas was 12,700 cubic feet per head per annum. In such a suburb the consumption might be increased much further if only proper steps were to be taken to bring to the notice of the residents the great advantages of a gas-fire for warming well furnished rooms. A gas-fire was peculiarly advantageous for employment in a bedroom, where it was specially desirable to be able to raise the temperature sharply in the shortest time possible and to lower it again as rapidly. Even in large buildings, the use of gas-firing was beneficial. For example, the head offices of the Imperial Gas Association in Berlin consisted of two houses containing sixty-eight rooms, in which 137 officials were engaged from 8 a.m. to 4 p.m., while six porters and 48 messengers required accommodation every day for short periods of time. In these offices gas-heating was so much liked that Herr Körting had recently been requested to remove the last of the existing coke-stoves. The total consumption of gas for lighting and heating the whole premises was 2,320,000 cubic feet per annum, worth at the present selling price about £400. This was a sum of money which was too small to be appreciable in the accounts of any large house of business such as a bank; and it would be much better for establishments of the kind to adopt gas-fires than to trouble about systems of heating the whole of their buildings by means of coke consumed in one or more centralized furnaces.

Make and Consumption of Coke Expressed as a Percentage of the Coal Carbonized.

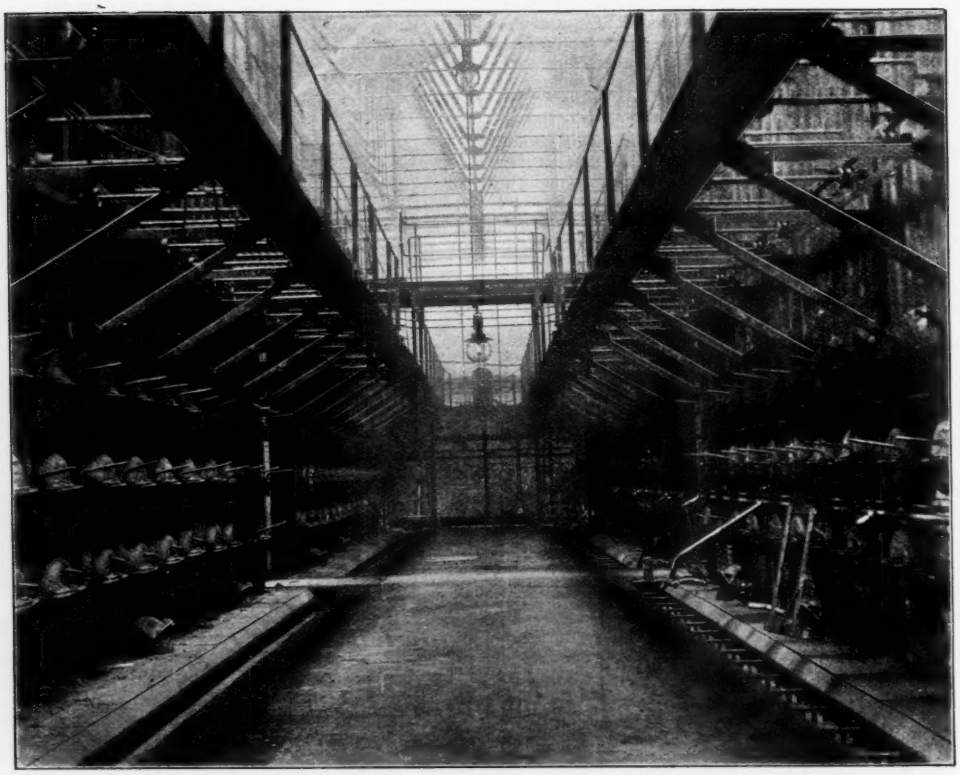
—	1. Direct-Fired Retorts.	2. Regenerative Furnaces.	3. Regenerative Furnaces, High Temp., Mechanically Worked Retorts.	4. Inclined Retorts and Auto-Carburation.	5. Vertical Retorts.
Gas made per long ton, cub. ft.	10,750	10,750	11,500	12,350	12,900
Coke made, per cent.	70	70	70	70	70
Consumption—					
Heating retorts	22	12	14	12	15
For power	2	2	2	2	2
Charging and drawing machinery	—	—	3	—	—
Coal and coke handling plant	—	—	3	3	3
Water gas manufacture	—	—	—	4	—
Steam raising	—	—	—	—	1
Total consumption	24	14	22	21	21
Coke available for sale	46	56	48	49	49

Gas Engines in America.

In the course of an article in the "Times Engineering Supplement" on the "American Gas Engineering Industry," Mr. H. E. Wimperis says that, compared with Europe, the United States has been slow to adopt gas-engine working; but there are now many signs that progress is being made. The most extensive installation of which he is aware is that at San Francisco, where the California Gas and Electric Company have had an enormous plant put down for supplying the necessary mechanical power for the operation of their electric generators. At present it consists of three units of 4000 H.P. each. Another is being erected, and the foundations laid for a fifth. It is intended ultimately to increase the output to 40,000 or 50,000 H.P. Previous to the installation of this plant, the largest which had been put to work were those at the Lackawanna Steel Company, of Buffalo, and the big pumping plant installed at the centre of the natural gas industry in the east. In Germany, Mr. Wimperis remarks, the large gas-engine has generally been associated with the utilization of waste gases from blast-furnaces; and the extent to which this principle has developed in that country is very great indeed. Possibilities in this direction are governed by the annual output of pig iron, and by the efficiency with which the process is being worked; and the output of pig iron in the United States is more than equal to that of Germany and Great Britain combined. Another source of power which does not appear to have yet been utilized in the United States is that of the waste gases coming from the coke ovens used to produce coke for metallurgical processes. In fact, the waste power available is of enormous amount. After detailing some cases of engines worked by blast-furnace gas, suction producer gas, and natural gas, Mr. Wimperis concludes by stating that practical tests of machine peat as a producer-gas fuel have recently been carried out by the United States Geological Survey. Two kinds of peat were tested—one partly raw and partly machine-treated peat, and the other entirely machine peat. It was found that the raw peat was unsatisfactory in working, as it produced very poor gas. On the other hand, machine peat, procured from Florida, gave very good results, both as regards reliability and calorific power. The general conclusion is that machine-dried peat can be used with success in producer plant, and is, indeed, better fitted for that than for use with steam-boilers. This, he adds, opens a further field for the use of gas-engines; and it will be interesting to see how far advantage is taken of it.

THE STOCKPORT CORPORATION GAS-WORKS.

An Official Inspection.



View on the Drawing-Floor of the Inclined Retort-House.

Opportunely, the Chairman (Mr. Councillor James Fernley) and members of the Stockport Corporation Gas Committee have afforded their colleagues of the Council an occasion for making a special inspection of the gas-works. We say "opportunely" because three parts of the new large inclined retort installation and the coal and coke conveying and storing plants (which have their novel features) are now in daily work; and it is expected that they will be fully employed as the winter progresses. That the members of the Council who are not specially engaged in the administration of this important public service are deeply interested in its working and processes was evinced by the fact that between forty and fifty of their total number of 64—including his Worship the Mayor, Alderman Henry Bell, D.L. of Cheshire—made it convenient to be present at this official inspection last Wednesday. The others were denied the pleasure through business engagement or, regrettably, through illness.

Meeting in the Committee-room, the visitors were very cordially welcomed by Mr. Fernley, who expressed the gratification of himself and his colleagues of the Committee that so many had found it convenient to attend. The large company were then divided into parties; the first being headed by Mr. S. Meunier, the Corporation Gas Engineer, and subsequent ones by the Assistant-Engineer (Mr. G. Hutchinson), the Chief Draughtsman (Mr. Allsop), and other of Mr. Meunier's willing assistants. The Contractors, Messrs. Gibbons Bros., Limited (retort benches and settings, bench ironwork, coal-hoppers, measuring-chambers, and shoots), and Messrs. Robert Dempster and Sons, Limited (coal and coke handling plant), were represented respectively by Mr. J. M'Ewen and Mr. E. J. King. The Lancashire Dynamo Company's Representative (Mr. Mason) was also present.

It is some time since the members of the Corporation have officially visited the works; and they were hugely impressed with the vast changes that have been made in them under Mr. Meunier's scheming; for scheming involving ingenuity and much anxiety there has had to be with circumstances throwing considerable obstacles in the path of the making of a straightforward job in modernizing and extension. Not only did the vast changes impress, but the large advances that have been made in manufacturing process with the view to economical and maximum production also riveted attention. Naturally, the first part of the work visited was the old retort-house, in which, in place of twelve beds (running down the centre of the house) of direct-fired retorts, comprising 66 in all, Mr. Meunier has packed in 192 inclined 15-feet retorts, divided into four benches, four arches to a bench, and twelve retorts (set in four vertical tiers) to a bed. It will be remembered that a full detailed description, with illustrations, of this inclined retort installation and its auxiliary coal and coke handling plant was published in the "Journal" for April 9, 16, and 23; and all the visitors to the gas-works last Wednesday were handed reprints of the articles. In view of that publication in our columns, there is no occasion to again enter into the details of the installation. Readers, however, may be reminded that there are three particularly interesting features about the house. One is that the regenerator parts of the new settings is recessed to give more space on the clinkering-floor; the second that, in view of the tight fit of the benches in the house, and consequently the necessity for making conditions bearable for the men, Mr. Meunier has given the benches an insulation of slagwool between the superficial and inner brickwork; and the third that the old strongly constructed central main flue has been retained. This main flue is situated about 2½ feet below the discharging-floor between the parallel double benches. Now that the settings are at work all down one side of the house and one-fourth of the retorts on the other side, some notion can be gained as to the success or otherwise of Mr. Meunier's provision for the protection of the workers from heat. The day to put that provision to the proof is one when a high atmospheric temperature prevails; for what exists inside the house on such a day is the worst condition in respect of heat that there will be there. Last Wednesday was really sultry; so much so that it was fatiguing walking about the works in the open air. But under such oppressive conditions, the heat in the retort-house it can conscientiously be said was not worse, in fact was more endurable, than in several inclined retort-houses it has been our lot to visit. The method of insulation answers admirably; the radiation from the benches being reduced to a minimum. It cannot, however, be denied that on the discharge floor, the old central main flue causes an upward ascent of heat; but the modification of this is not beyond possibility and the scope of engineering. A structural alteration is in the Engineer's mind, whereby he will ventilate the flue on the exterior with outlets to the open air. A difficulty of this kind, though one peculiar to an individual works, is of general engineering interest.

It will be borne in mind that the retorts are only 15 feet long; and, at the present time, they are being worked with 5 cwt. charges, or 12 tons per bed per day. Therefore the duration of carbonizing is six hours. The visitors watched with interest for some time the discharging of the retorts; and then went on to the upper floor to see the operation of charging. While here they observed the excellent provision that has been made in the shape of outside covered balconies to give passing way for the operatives and place for fresh air when not engaged in charging. Some of the venturesome councillors even went and examined, from the numerous platforms provided for facilitating attention, the coke-conveying and other plant.

The coal and coke plants were working exceedingly well; and considering their novel features, their extent, and so forth, witness must be borne to the fact that, since it started on its work in

April last, it has required the minimum of attention here and there in the way of adjustment.

Neither from the retort-settings nor from the coal and coke plant can any working details be given, because in connection with both it has been a period of training with the men; it being for them quite a revolution in the system of working. Therefore there must be regular operation before proper and dependable figures can be realized.

From a thorough inspection of the new plant, the visitors turned to an examination, and explanation of the purposes, of the other parts of the plant—from the condensers onwards. We will not occupy our readers' attention by going into details; but it may be said in passing that Mr. Meunier is now using, in a Livesey washer, a naphthalene solvent, of a specific gravity of 1·023 at 60° Fahr., from his carburetted water-gas relief holder. This may be more of a tar oil than actually tar. From Mr. Meunier's records, these particulars are taken of the use of Mr. Colson's solvent in the washer between Aug. 19 and Sept. 19, 1906: Number of times solvent changed, 2; gas passed, 16,790,200 cubic feet. Between Aug. 19 and Sept. 19, 1907, the washer was filled with carburetted water-gas tar solvent. Number of times changed, 2; gas passed, 38,764,200 cubic feet. In this case, the maximum efficiency is when the solvent is frothing well, which ceases when the solvent gets saturated with naphthalene, and sinks to the bottom of the washer. In the case of Mr. Colson's solvent, it was floated on the water; but as will be remarked from the specific gravity of the carburetted water gas tar, the method has been altered, and the Livesey washer entirely filled. So long as the contents of the washer can be kept in a frothy condition, no trouble with naphthalene appears, but as soon as the frothing begins to disappear, then a few complaints commence to arise. With regard to the figures quoted here, we do not lay much stress on them, because they are only taken over a month; and to be really valuable, they should be for a longer period, with such additional information as the number of complaints, the temperature, and the state of the weather for the corresponding periods. Mr. Meunier himself suggests that it is quite possible the latter cause alone has been favourable to this year; but off hand, he fancies there have been rather more complaints this year than last, though the number has been very slight.

The visitors were all greatly interested in the machinery house—listening attentively to information given as to the uses of the exhausters. In one part of the house, there are engines and compressors for high-pressure distribution, by which plant gas is sent at a higher pressure than ordinarily through a line of 4-inch steel pipes for the better supply of a district some five miles distant. The engines are of 35 indicated horse-power; and the compressors are of the Ingersoll-Sergeant Drill Company's type. Their maximum capacity is 24,000 cubic feet per hour at 150 revolutions per minute. The compression is to 7½ lbs. in the summer and 12 lbs. during the winter. This leaves a reserve of 3 to 5 lbs. at the inlet of the regulators. One of Bailey's reducing-valves is placed at the outlet of the receiver, and set to give the pressure required on the main. Valves are placed every mile on the main; the first one being ½ mile away. Pressure test-boxes are also fixed every mile. The regulators are of Crawford's pattern—the first regulator reducing from 3 to 5 lbs. to 1 lb.; and the second reducing from 1 lb. to the pressure required in the district. The purifier-houses were next inspected. The old water-lute purifiers were seen; and then the four large boxes, with eight lids to each box, on Green's system, each box holding about 90 tons of oxide. An interesting feature of this house is the means of conveyance for the oxide. There are overhead rails on which runs a small electrically worked carriage supporting an iron skip and a seat for the operator. The purpose of this is to lift the revivified oxide from the floor below, and to convey it to the purifier being filled. The experimental gas-making plant, the chemical laboratory, and the workshops were all viewed. In the last-named, the machine tools were busily employed; for in a works the size of those at Stockport there must ever be repairing work in hand, and this must increase with the extension of mechanical operation, and call for the greater employment of good craftsmen. In the workshops, in addition to parts of heavy plant, meters and lanterns were also seen under repair, and repaired meters under test.

Subsequently the members of the Town Council and others were entertained to tea at the Warren Bulkeley Hotel, where Councillor FERNLEY, the Chairman of the Gas Committee, presided.

The CHAIRMAN, after the loyal toasts, stated that while a member of the Gas Committee he had taken great interest in the work of the retort equipment as far as a layman could do; and he was sure that the ratepayers' money in the undertaking was well invested. He then called upon Mr. Meunier to give an explanation of the work done.

Mr. MEUNIER explained the new plant at considerable length, and, adding to the description which has already appeared in the "JOURNAL,"* said that the plant which had been done away with was built somewhere in the seventies. He had never been able to find out the exact year; but he thought it was in 1874. It was of the ordinary horizontal type of retorts, with direct firing. The plant was getting worn out, and the question cropped up as to what should be done to replace it. After a good deal of consideration, the Committee decided to go in for inclined retorts. The difficulties were very great. The house was only 64 feet in width; and it was necessary that there should be two settings installed. An experimental setting was put in during 1903 and 1904, at a cost of £1250. The setting worked continuously for twelve months; and the only time when any difficulty was found with it was in the hot weather in September, when it was necessary to open the ventilators which had previously been purposely closed. This turned out so successfully that the Committee decided to extend the process, with the result that they had seen that day. The next question was how to handle the coal and coke; and it was this which engaged the attention of a Sub-Committee for some time. They went round a number of works and inspected the systems which had been put in by various firms, and ultimately it was decided to place the order in the hands of Messrs. Robert Dempster and Sons, Limited, of Elland. The Committee were so pleased with the working of the one at Shrewsbury, that they thought it would suit their purpose much better than any other. The cost of the retort-settings was £17,500, and the conveying plant £8443. There was nothing very special with regard to the coal elevating and conveying plant—that was in pretty general use in various parts of the country; but the coke conveying and elevating plant was somewhat new. It was thought it would be an improvement to have an additional elevator, so that as long as there was room it should be a continuous process without any manual labour, and that the ordinary storage bunkers should be only used when the others were full or in case of necessity. The Local Government Board inquiry was held in May, 1906. The total amount asked for was £25,000; and the Board granted £21,826. The difference of £3172 was considered by the Board to be the value of the old plant, and this had to be paid out of the reserve fund. The work was commenced in May, 1906, and the first section was brought into operation in April, 1907. The coal-breaker was equal to a capacity of 30 tons per hour, and the twin elevators were each capable of lifting 30 tons per hour. The capacity of the coke-conveying plant was 15 to 20 tons per hour. Each storage bunker held 14 tons of coal, which was equivalent to a 24 hours' supply. With regard to the question of driving, it was originally intended to use gas-engines, which was the usual plant in gas-works; but the Chairman of the Electricity Committee had a communication with the Chairman of the Gas Committee, with the result that it was decided to have electric motors, each of 12 H.P. The motors had an advantage in saving a lot of shafting. The capacity of the crane skip was one ton; and it could be filled and emptied again very comfortably in two minutes. The coke was not only stored for sale, but thoroughly screened; so that they got nothing but big coke in the two large bunkers, nothing but dust in the second bunker, and small coke in the other one. As a matter of fact, they could load a cart with 25 to 27 cwt. of coke inside a minute. The Committee were now doing what they could to develop a ready sale for the whole of these sizes. With reference to the capacity of the retorts, there were twelve to each bed, and four beds to the section, each 15 feet long; and they charged them with 5 cwt. of coal at a time. The coke-storage bunkers held 60 tons, so that they had a very fair capacity. With their present six-hour charges, they were carbonizing 12 tons 12 cwt. per bed per twenty-four hours, or more than one ton for each retort. If they went on four-hour charges, they could do from 14 to 15 tons. It was anticipated that there would be great economy in the use of this system, which was by no means a new one, but which was a new adaptation of something which had been in vogue for fifteen years. The use of retort-house governors was new, and they were found to be a distinct advantage—there was less watchfulness necessary in the engine-house. The governors should pay for themselves in the first twelve months.

Councillor BREWSTER submitted the toast of "The Contractors." He said the work had been going on for some time, but they had had many obstructions in the way of old buildings and old plant to contend with. They had put retorts in a house of such a width as had never been attempted before; but he felt confident the Contractors would justify what had been done. They thought they had adopted a system which was practically the last word in gas engineering. The plant had a substantial appearance about it, and everything seemed to indicate that it would do all that the Contractors claimed for it. The comparative statistics issued at the close of every year showed that at Stockport they obtained far above the average percentage of gas per ton of coal, they sold 94 per cent. of the gas produced, and paid more wages per ton of coal than a large number of gas undertakings in the country.

Mr. KING, who represented Messrs. Robert Dempster and Sons, replied. He said that their Managing-Director (Mr. Broadhead), who had had charge of the work, was unavoidably absent. He was glad to see that the Corporation were pleased with the work which the Contractors had done. He did not think there was any retort-house in the country which made so much gas, on the space occupied, as was done at Stockport. It was very much to their Engineer's credit that he had installed a work of this description. Mr. Meunier was the master hand, and the Contractors had worked under his instructions. They undoubtedly expressed Mr. Meunier's opinions in carrying out the work; and he ventured to hope they had been successful. It might be said that machinery would displace labour; but he thought it was much more advantageous to develop a man upon higher scientific lines than to always have him wheeling barrows filled with coal. By the introduction of this machinery, they got a higher class of mechanic than was in vogue; and what was lost in one direction was gained in another. It was a development in the right direction. He hoped the scheme would turn out to be a financial success, and a credit alike to the Corporation and to Mr. Meunier.

Alderman G. LEIGH, in moving a vote of thanks to the Gas Committee for the invitation to visit the plant, said the machinery appeared to him to be the very height of ingenuity and it worked with great precision. He believed that the results would justify the expenditure.

Mr. FAIRHURST, in seconding the resolution, said though they might have displaced labour by the new installation, they were satisfied that it was the best system to adopt. The work of the men had previously been most trying.

The vote of thanks was supported by Messrs. Skuse, Thomas, Stockton, and Widdowson, and heartily carried.

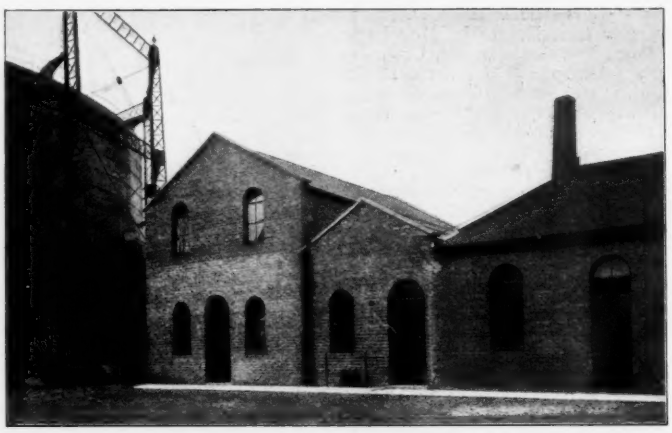
Mr. FERNLEY, in responding, said that in Mr. Meunier they had a Gas Engineer second to none in the country. The undertaking since he took it in hand had been very satisfactory indeed, and as a commercial enterprise it would pay large dividends. If it was a private concern, many of them would like to be shareholders.

* See "JOURNAL," Vol. XCVIII., pp. 87, 150, 218.

GAS-WORKS IMPROVEMENTS AT STIRLING—INSTALLATION OF STOKING MACHINERY.

At Stirling last Tuesday, the inauguration ceremony took place in connection with various improvements that have been effected at the gas-works there, including the introduction of an installation of charging and discharging machinery, of which the following interesting account has been supplied.

In order to cope efficiently with the ever-increasing demand for gas at Stirling, an addition to the carbonizing plant has been found to be very necessary; and as the existing retort-house was already filled with two benches of sixes—one each side of a chimney, one bench consisting of four settings of sixes, the other eight settings of sixes, built on the shallow regenerator type—the question arose as to the best methods of altering or extending, so as to get the maximum results with the minimum of expenditure. After much careful consideration, the Engineer (Mr. J. D. Smith) finally decided to demolish the smaller of the two old benches, and instal in place of it a bench containing five through settings of eight retorts complete, with modern stoking machinery, coal-handling plant, electrical generating plant, and accommodation for a future installation of coke-handling plant. The complete contract for the whole of this work, including the pulling down of the old bench and the excavating and concrete foundations for the new one, was entrusted to Messrs. Robert Dempster and Sons, of Elland, to whom much credit is due for the completion of the whole contract in so short a time.



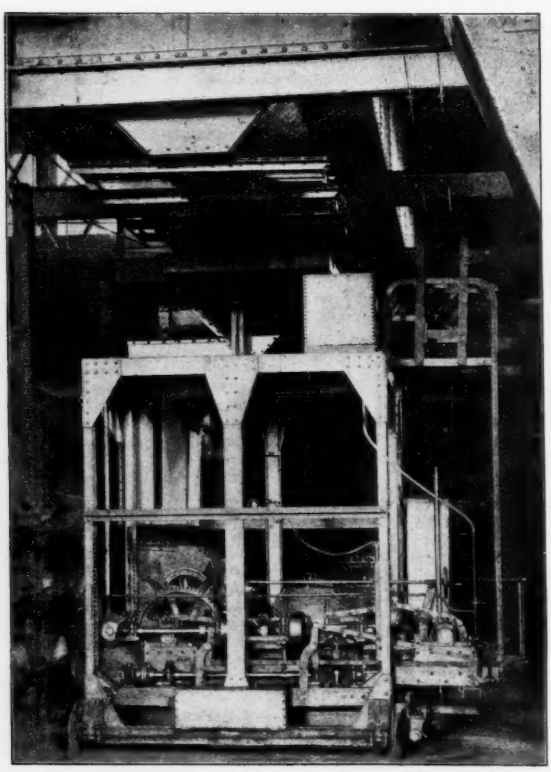
The building of the bench was commenced on March 11, and the settings were completely dried and ready for gas-making on July 15. The retorts are Ω shaped, 22 inches wide by 16 inches deep by 20 feet long. The settings are built on Dempster's patent regenerator system, with the furnaces on one side only—viz., on the opposite side to the charging machinery—thereby reducing the furnace work. The subway on the furnace side is 8 feet deep by 12 feet wide; while on the stoking machinery side the subway is the same depth, but only 9 ft. 9 in. wide, as there is nothing to do on this side except to regulate the admission of secondary air and to regulate the dampers. The subways are provided with special ventilators for extracting superheated air. The front walls of the bench are packed with slag-wool to prevent any loss of heat by radiation; and the whole bench is securely braced together by stout buck-stays, cross joists, and other bracing.

The furnace charging door and opening in the brickwork have been specially shaped so that the coke from the machine charges when put out can pass freely into the furnace without choking; and a special furnace charging shoot has been made, suitable for use with the "pusher-out." Another special feature of the new bench is the fact that the ascension pipes are on one side only; each through retort being provided with one 8-inch diameter ascension pipe. This is, of course, somewhat of a departure from the usual Scotch practice where a minimum of 20-candle power gas is the rule. Results, however, fully bear out the wisdom of the scheme, as the photometer tests show a gain of ½ to 1 candle power by the new plant as compared with former results. The ascension pipes are fixed on the furnace or discharging side of the bench; thus minimizing the work to be done on the other side to opening and closing the mouthpiece lids and the operation of the stoking machine.

Still another special feature of the plant is to be found in the hydraulic main, which has been arranged with a continuous open seal for the whole length of each hydraulic over each arch, sufficiently wide to allow of cleaning out operations (should these ever be required) with a minimum amount of trouble, as this seal chamber is only covered by light loose lids fitted with a handle, merely to keep dust out of the main. A tar-tower has been connected up to the tar main and the retort-house governor fixed to the foul main, both of which will have helped to obtain the increase in the illuminating power of gas made in the new setting. In the same contract, an Everitt's tar-extractor was included, which was fixed on the inlet pipe to the existing condensers. The working of this has resulted in an immediate reduction of 50 per cent. of the naphthalene troubles, as fully described by Mr. J. D. Smith in his paper read before the recent meeting of the North British Association, and given in the "JOURNAL" for July 30, p. 323.

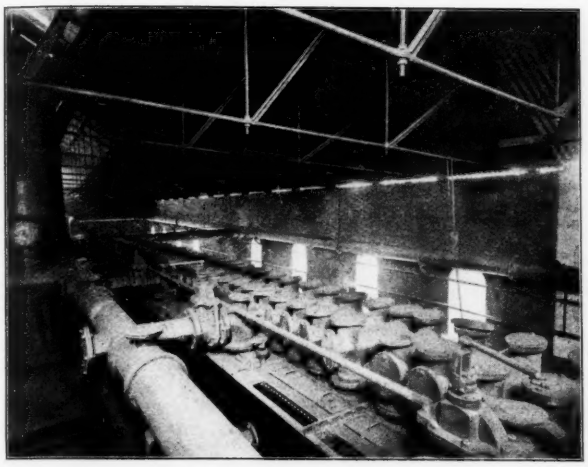
The stoking machinery consists of a combined charging and discharging machine, the motions of which are power driven. The power is obtained from one electric motor; all speeds and various motions being worked by one controller handle—thus reducing the work to the simplest proportion. The power is transmitted from the motor to the charger, pusher, and travelling and hoisting gears by means of Toogood's patent double-coil friction clutches, of which Messrs. Robert Dempster and Sons, Limited, are the sole makers. The machine is very strongly built and very compact in construction, measuring only 14 ft. 9 in. high, 12 ft. 8 in. deep, by 10 ft. 2 in. wide. The charger can be worked so as to throw any weight of coal into the retort at the will of the operator. It has already been found that the resulting coke is of far harder and superior nature to that obtained from the same coal by hand stoking; this being due to the homogeneous nature of the machine charge and to the steady action of the pusher in handling the coke, and has already resulted in a higher price being obtained for the coke, which is easily pushed out and does not buckle.

Turning to the coal plant, it will be noticed that the coal is delivered into the works in hopper-bottomed waggons belonging to the Gas Company. These waggons are emptied into a large receiving hopper, from which the coal is automatically fed to the breaker, by means of Messrs. Dempster's sure-feed arrangement, at a rate of 20 tons per hour. The sure-feed is so arranged that no part of the plant can become choked through overloading. The feeding arrangement delivers the coal to a breaker, which reduces the large pieces to a suitable size and conveys it to the elevator boot. The elevator is of the cased-in type, and delivers the coal direct into a longitudinal conveyor of the lattice braced push-plate type, which is supported from the top of the series of coal bunkers running the length of the bench. In order to get as large a storage capacity as possible with the bunkers, without in any way altering the roof, the conveyor was arranged to pass through the principals and the bunkers to come up as high as possible under them. By this means bunker capacity of 80 tons has been obtained. The outlet doors from these bunkers have been so arranged with mechanism that one simple opening device on the machine will operate all the doors.



The Combined Charging and Discharging Machine.

The complete coal plant is driven by a motor, which is a duplicate of the one that is on



The Hydraulic Main Arrangements.

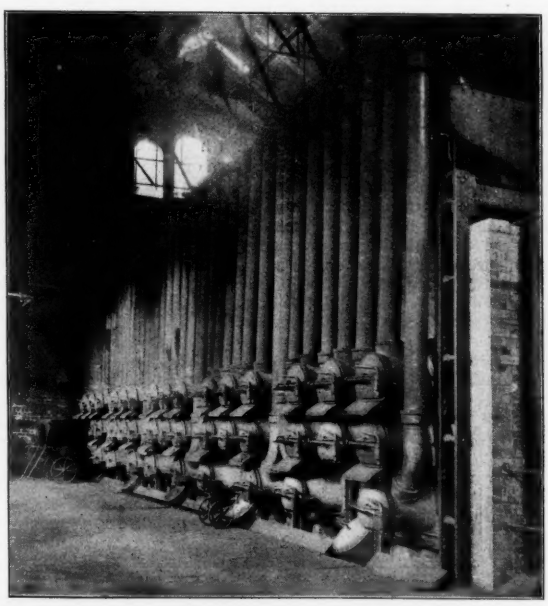
the stoking machine; so that full advantage may be taken of the interchangeability of parts.

The generating plant consists of a 45 B.H.P. "National" gas-engine, driving a 42 B.H.P. dynamo by a 9-inch belt; the engine and dynamo having purposely been installed larger than necessary, in order to develop sufficient power for possible future extensions, or for power to drive a coke conveyor should one be adopted in the future. The Manager has displayed great foresight in the arrangement of his switchboard, which is provided with a three-way switch coupled in such a manner that the whole plant can be worked from his own generating plant or from the town's electric supply; both being at the same voltage—viz., 460. In this way, should it be found more economical for light summer loads to work from the town's supply, it can be done very readily; or the generating plant may be stopped without inconvenience for repairs, if found necessary. The supply of gas to the gas-engines is taken direct from the gasholder; the pressure being reduced to suit the engine. A new power house has been built, with workshops and overhead stores alongside (which was also built by Messrs. Dempster and Sons), which is very spacious, and neatly finished in glazed tiles of a pleasing colour scheme.

The heats of the new retorts now at work are even end to end. The retorts are very economical in fuel consumption; and the plant as a whole leaves nothing to be desired. It is evident that full advantage has been taken of the existing arrangement of the works; and Mr. Smith is to be congratulated on the able way he has provided for dealing with any call on his gas supply.

A company of invited guests, including representatives of the Town Council and a number of gas managers, assembled in the retort-house, to take part in the ceremony.

Mr. J. W. Broadhead, of Messrs. Robert Dempster and Sons, Limited, of Elland, the Contractors, said that, on their behalf, they were pleased to have with them Mr. James Johnstone, the Chairman of the Stirling Gaslight Company, who would put the plant into operation. The installation consisted of through retorts, in five arches. There were no ascension pipes on one side of the bench; so that the work of the machine attendant was confined to the opening and closing of the mouthpiece doors and working the machine itself. The coke required for the furnace was pushed out on the other side, and fell direct from the oven into the furnace. It was a most complete installation for a gas-works, not only of that size, but of almost any size in the United Kingdom. There was a coal-elevator, which carried the coal direct from the waggons into overhead bunkers capable of holding 80 tons untrimmed, and 100 tons trimmed. In addition to the plant in the retort-house, there was electric generating plant in the workshops across the yard, from which the power was derived for running the machinery. Before asking the Chairman to officially put the machinery into operation, he could not allow the opportunity to pass without making a small presentation to him, to celebrate the occasion. He had pleasure in presenting him with a silver rose bowl, with the inscription upon it "Presented to Jas. Johnstone, Esq., Chairman of the Stirling Gaslight Company, at the inauguration of the stoking machinery and new carbonizing plant at the Stirling Gas-Works, 17th September, 1907." He presented the bowl as a small token of the esteem and regard in which Mr. Johnstone was held by the Contractors, and by all who were then present. He hoped he would be long spared to act as Chairman of the Company, and that he and his colleagues, and Mr. Smith, the Manager of the works, would always look back upon this occasion with pleasant memories.



Inside the Retort-House.

The Chairman said he had no idea there was to be anything of this kind, and he did not know any reason why such a beautiful rose bowl should be given to him. The only reason he could think of was that in all their work they had got on very well with the Contractors. He thanked them heartily for the present.

[The Chairman then charged a retort, the operation occupying only a few seconds; and he discharged another, which was accomplished in less than thirty seconds. Afterwards the work of charging and discharging several retorts was illustrated by the workmen. The duration of the charges, it was explained, would be six hours.]

The company were subsequently entertained by the Gas Company to luncheon in the Station Hotel.

Mr. J. Hepworth (Edinburgh) proposed the toast of "The Stirling Gaslight Company." He was glad, he said, to be the medium of voicing the pleasure they had had in seeing the latest addition to the works of the Stirling Gaslight Company. He had had some little acquaintance with the Stirling Gas-Works in his time. A great deal of water had passed under Stirling Bridge since he first visited them. He was perfectly astounded when he looked round and saw the great changes which had come over the works within the last ten years. Ten or eleven years ago the annual production of gas at the works was 60 million cubic feet. Everybody would be surprised to know that to-day the Company were sending out 120 million cubic feet annually. The capital, of course, had had to be increased in the interval. The price of gas in those days was 3s. 4d. per 1000 cubic feet; and if their friends the coal merchants had not raised the price of coal, it might have been 2s. 6d. to-day. As a matter of fact, it was 2s. 6d. until the Directors, compelled by the force of circumstances, recently made it 2s. 10d. He believed that the number of consumers went on steadily growing, but not in the same proportion as the consumption increased. He was told that the number was formerly about 5000, and that there were now about 6000. He had been asking himself what this state of things was due to. The prosperity of the Company, it seemed to him, was due to two very obvious causes. In the first place, there had been enterprise on the part of the Directors and of the Manager, which had secured a largely increased consumption, and by this increased consumption the Company had been seeking to reduce, and had succeeded in reducing, the price of gas to the very low figure he had mentioned—a price lower than they were paying in Edinburgh. Then there was a second cause—and everyone of them had been forcibly reminded of this second cause, in what they had seen that day—improvements in the methods of manufacturing gas, by the adoption of such machinery and plant as they had seen. It was often said that anyone could make gas if he only had the right kind of coal. Well, that was quite true; anyone could. But to produce good gas at a cheap rate, and to produce such remarkable results as had been produced in Stirling within about ten years, meant that the best scientific methods had been brought into play and the most perfect mechanical methods had been adopted. Much of the success which had attended the efforts of the Directors was due to Mr. Smith, the Manager. In him the Company had an exceptionally able official. He had laboured strenuously, to his knowledge, to bring about the results referred to. In their Secretary—Mr. Gentleman—the Company had an official whom everyone might envy. What he had said was enough to emphasize the fact that now-a-days it was not coal alone that was wanted to make gas. They wanted the application of brains; and the adoption of machinery such as they had seen was the correct explanation of the phenomenal success of the Stirling Gas Company.

The Chairman, in acknowledging the toast, said that Mr. Hepworth had been a true friend of the Company for many years. He almost reckoned him as one of themselves. He thought the greatest cause of the success of the Company had been their Manager. They were very fortunate in securing such a gentleman as Mr. Smith. He had a thorough knowledge of everything in connection with gas making, and filled up every little crevice that he found, in some way or other. He had a faculty for seeing things before, and applying his remedies before anything took place. Had it not been for Mr. Smith, he was sure that they would not have been in the position in which they were at the present time. The amount expended on the works had been nearly £60,000. Of this, there had been £10,000 paid out of revenue for the extension and restoration of the works; and, as Mr. Hepworth had said, the production of gas was double what it was nine years ago. It had always been the aim of the Directors to serve the public in the best way

they could. They had tried at all times to keep the price to the consumers as low as possible; and it would be their endeavour to continue this course.

Mr. D. CHRYSTAL, the Solicitor to the Company, proposed "The Provost, Magistrates, and Town Council of Stirling," which was acknowledged by Bailie WATT, who said there was a fallacy abroad that there was some secret antagonism between electric light and gas light. Nothing could be further from the truth. Years ago the late Sir William Siemens said that no holder of gas shares need feel alarmed by the prosperity of the electric light industry. The representatives of the Town Council there felt impressed by what they had seen; and he knew that he was speaking the mind of his colleagues when he said that he trusted that the prosperity of the Company might continue, even in a greater degree than in the past. The prosperity of the gas undertaking meant the prosperity of the people of Stirling. The prosperity of the Company meant cheaper light for the consumers; and there should be no rivalry between those who represented the electric current and those who manufactured gas.

Ex-Provost KINROSS having proposed "The Contractors,"

Mr. J. W. BROADHEAD, in reply, said they were very pleased indeed to have had the opportunity of doing work for the Stirling Gaslight Company; and now that it was finished, they were very glad that they had been able to go through a work of some difficulty without a single hitch having occurred. In Mr. Smith they had had every assistance any contractor could possibly have, in carrying out the work. They, as Contractors, had to give certain guarantees before they began the work; and he was gratified to learn from Mr. Smith that he would have no difficulty in advising his Board that the guarantees had been more than met, and that the policy he had submitted to his Directors would bear very good results. The make of gas per ton was more; the illuminating power of the gas was greater from the same quality of coal; the fuel consumption was considerably less; the coke was of much improved quality, and realized a higher price per ton; carbonizing wages were reduced by about 1s. per ton, and would be reduced still more; and last, but not least, the work would be done under more humane conditions.

Mr. CHRYSTAL proposed the health of the Manager. There was no one man, he said, to whom the prosperity of the gas undertaking was due, more than to Mr. Smith.

Mr. SMITH, in acknowledgment, said that the prosperity of the Company was due, in very large measure, to the Chairman, who faithfully visited the works at least once a week. They could imagine what a support this gave to the Manager.

The proceedings were then brought to a close.

INVESTIGATIONS ON THE LONG-DISTANCE GAS-MAIN AT ST. GALL, SWITZERLAND.

SOME experiments upon the phenomena attendant upon the long-distance transmission of gas at high pressure were carried out during August last year, at St. Gall, Switzerland, under the superintendence of Professor A. Fliegner, of Zurich. The methods employed, and the results obtained, were described with great wealth of detail in the course of an article running through several recent issues of the "Journal für Gasbeleuchtung;" while a useful abstract of the general conclusions drawn by Dr. Fliegner from his researches was printed in the "Schweizerische Bauzeitung." The particulars given in the following lines are obtained from the two sources mentioned (see also *ante*, p. 227).

The first gas-works erected to serve the town of St. Gall were built in 1857. Owing to the growth in population of the town itself and the surrounding country, the works required enlargement about the year 1890; but only a comparatively short time afterwards the plant was found insufficient to cope with the local demand for gas. It was therefore decided to build an entirely new works; and after various proposed sites in the immediate neighbourhood of the town had been examined and rejected for one cause or other, it was finally arranged to place the new works at Riet, on flat ground near Rorschach, a village on the shores of Lake Constance close to the works supplying St. Gall with water. Thus the new gas-works were situated, roughly, 6¼ miles away from St. Gall, and 820 feet below the level of the town. The plant on the works comprised a two-lift telescopic holder, having a storage capacity of about 212,000 cubic feet, connected by means of a main 13·8 inches in diameter with two single-lift holders at St. Gall, each holder having a capacity of 330,000 cubic feet, but so designed as to be capable later on of being telescoped.

Owing to the difference in level between the works and the town, the natural ascensional power of the gas was sufficient to force it to the place of consumption as long as the demand remained reasonably small; but since it was anticipated that the consumption would soon grow, the owners decided to adopt the system of high-pressure transmission. Two Enke's blowing engines, each having a maximum capacity of 1900 cubic feet per minute, were therefore laid down, each driven by its own 16 H.P. Oerlikon electric motor. The gearing was so arranged that each blowing engine could be driven by its own motor at any of five different speeds—viz., at 36, 53, 71, 90, and 101 revolutions per minute; while by coupling both motors to one blowing engine, the latter could be driven at 130 revolutions per minute. Gas was also supplied direct from the low-level holder on the works through different mains to the neighbouring villages of Rorschach, Goldach, and Horn. These places, however, consumed but little gas; and at the time when the experiments were in progress, at least 90 per cent. of the total make was forced through the high-pressure main to St. Gall.

The experiments had for their object to ascertain the amount of energy consumed by the electric motors in driving the blowing engines at different speeds, the quantities of gas propelled through the main by the engines when running at different speeds, the general effect upon the gas (if any) produced by so propelling it at different speeds through the main, and the coefficient of friction set up during its passage. Owing to the fact that the plant at the low-level station was insufficiently equipped with meters accurately showing the total make and the proportions thereof supplied to the three villages mentioned, as well as to St. Gall itself, and also owing to the possibility of errors arising through the difference in level between the two ends of the high-pressure main, various complications were encountered in carrying out the tests. It was found necessary accurately to calculate (*e.g.*) the following factors: The capacity of the gasholder on the works per unit rise of the bell and, since the holder was telescopic, to calculate the internal diameter both of the bell itself and of the lift; to ascertain exactly the volume of gas passing into the holder from the manufacturing plant during the time when the gas passing out of the holder into the main was being measured; to measure the pressure thrown when the lift was grounded, when both lift and bell were high, and also during the interval when uncupping was taking place; and to determine with the utmost precision possible the mean temperature of the gas passing into the main. At the other end, the operations were somewhat more simple, inasmuch as it was possible before each experiment took place to pass sufficient gas into one holder at St. Gall to keep the town fully supplied during the progress of the experiment, and to use the second holder as the recipient for the gas forwarded from the works. The holder at St. Gall employed to receive the gas had also, of course, to be calibrated and to be provided with the best arrangements possible for ascertaining the mean temperature of the gas on arrival. On the whole, it was found advisable to calculate the amount of gas made on the works and sent into the high-pressure main in terms of weight, and to treat the gas received at St. Gall in a similar fashion. Owing to the nature of the intervening country, the presence of a railway, &c., the necessity for having numerous curves (some of them of sharp angle) on the main, several spots occurred at which the general ascent of the pipe was unavoidably interrupted by a brief descent. Hence a number of syphon boxes were provided for condensed water, and the opportunity was taken to utilize nine of these boxes as places for investigating the pressure, temperature, &c., of the gas on its way from the works to the final storage holder.

A profile of the main is given in fig. 1 herewith, where the upper abscissæ represent the horizontal length of the pipe in kilometres, and the lower abscissæ give its length in miles, while the ordinates show the rise in metres and English feet above sea level or the outlet of the blowing engines at the works. The small circles inscribed with black crosses rising above the main in the diagram represent stop-valves. The small black squares depending

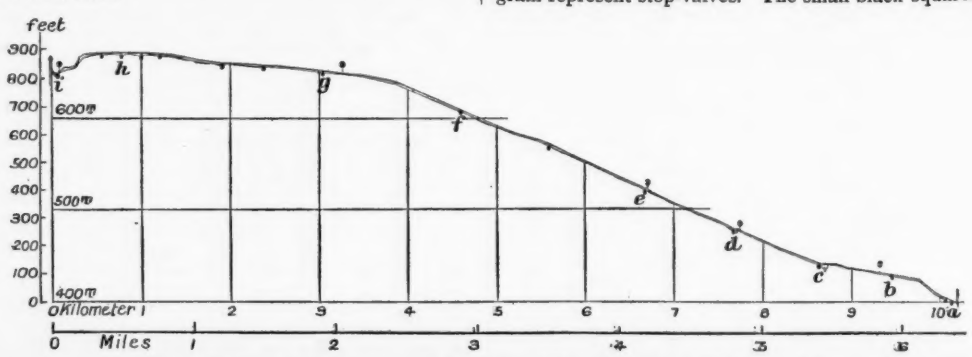


Fig. 1.—Profile of the Long-Distance Gas-Transmission System from Riet to St. Gall.

from the main indicate the syphon boxes; those at which the investigations were carried out being distinguished by small letters of the alphabet from (*a*) close to the factory to (*i*) near St. Gall. Further details as to the precise horizontal distance of each syphon box from its neighbours and from the factory, and its height above the latter, are recorded in Table I. after recalculation of the author's metric data into miles and yards and into feet respectively. It should perhaps be explained that the length of main between the boxes *a*—*b* contained a good many sharp curves as viewed on a ground plan; the length *b*—*c* contained one curve, but was otherwise straight; the length *c*—*d* contained a curve almost at right angles, and shortly before the point *d* passed upon a stone bridge over a railway, dropping into the ground again on the other side; the length *d*—*e* was mainly straight; the length *e*—*f* contained numerous gentle curves and a short fall: the length *f*—*g* was also almost straight; the length *g*—*h* contained the highest point of the whole main but was almost horizontal; the length *h*—*i* contained numerous horizontal curves of fairly short radii. The portion of main between the blowing engines and the syphon box *a* and the corresponding portion between the syphon box *i* and the governor house at St. Gall also contained syphon boxes; but the lengths were too short to render it convenient to carry out experiments in these places. The weather remained fairly favourable during the whole period of the tests especially in regard to the barometer, for only once was an alteration in the height of the mercury equal to 0·031 inch observed. On the other hand, the temperature varied a good deal—changing on one occasion by 4·7° Fahr. and on several other occasions by about 2° Fahr. during a single test. The temperature, however, only affected the conversion of the barometric height to the freezing point, and therefore did not produce much effect, more particularly because the temperature of the air was generally over 68° Fahr.

TABLE I.—*Positions of Syphon Boxes.*

Mark.	Distance from Blowing Engines. Miles.	Yards.	Height Above Blowing Engines. Feet.
a	0	111·5	10·5
b	0	770·6	91·2
c	0	1675·0	130·0
d	1	960·0	257·0
e	2	280·0	398·0
f	3	810·0	684·0
g	4	740·0	825·0
h	5	1450·0	886·0
i	6	490·0	820·0

EXPERIMENTAL METHODS.

As will appear later on, seven different complete experiments were carried out; the first under natural draught—that is to say, the gas being allowed to travel through the main by virtue of its own ascensional force—and the remaining six at different speeds of one or other of the blowing engines. The experiments lasted for four complete days; one being undertaken each morning or afternoon. The gas was first of all sent through the main under the conditions which were afterwards to be examined during a period of about half-an-hour, in order that thermal equilibrium might be attained, and then the experiment itself was begun, continuing as long as the store of gas previously made on the works would last. A delay occurred at the middle of each day while a further make of gas, sufficient for the afternoon's experiment, was being collected. Thus each individual experiment occupied from two-and-a-half to three hours. During the whole time of each experiment, measurements were made every fifteen minutes at both ends of the transmission system and at the nine syphon boxes already mentioned, of the various data which it was necessary to collect. Some of the temperatures, however, were only observed once in thirty minutes.

The apparatus represented by fig. 2, and shown in somewhat greater detail by fig. 3, was used at each syphon box to measure the temperature of the gas in the main; a thermometer being held by means of a cork inside the closed pipe descending within the suction tube of the box at such a point that the mercury bulb stood on a level with the axis of the main. The thermometer was withdrawn as quickly as possible each time it was read, and put back into position. The centre opening of the reducing T-piece led to a water-gauge for ascertaining the pressure. At first, a solution of zinc chloride having a specific gravity of 1·8 was used in the gauges, instead of plain water, as it was believed that the pressures would be such as to render the reading of a water-gauge in the open air by a man of ordinary height very difficult. The solution, however, proved unsuitable, inasmuch as it lost its homogeneity; and the use of plain water was therefore reverted to. The pressure of the gas in the two holders at the works and at St. Gall respectively was indicated by means of the ordinary water-gauges already in existence. The temperature was measured in a totally different way at the two ends of the main. On the works a thermometer was placed in a syphon box which was close to the mouth of the outlet pipe; but at St. Gall the temperature was estimated by graphically deducing the mean of the readings given by four thermometers suspended at different heights and at different positions in a horizontal plane within the holder.

The device employed for dropping the thermometers into the holder from the crown of the bell and for quickly withdrawing them when the readings were made is shown in fig. 4 where *a* is a cock, *b* a vessel containing an annular water seal, *c* a bell dipping into the seal, and *d* an orifice closed by a cork through which the string carrying the thermometer passed. In order to minimize the danger of breaking the thermometers when withdrawing them, a depending cone of paper was generally fixed by the observers at the mouth of the device. Serious irregularities were found in the readings of the St. Gall thermometers, owing to the effect of the sun, clouds, or passing showers on the exposed holder; the differences indeed ranging, according to the position of the individual thermometer, from 16° to 40°. The rise of the bell in each holder was measured by fitting them with three rods graduated in millimetres arranged symmetrically about their circumference and taking the mean of the three readings thus obtained. In the case of the St. Gall holder, the readings gave at once the capacity of the vessel; but, as already mentioned, in the works holder further corrections were required to allow for the difference in diameter between the bell and the lift. The mathematical processes used by the author in eliminating the

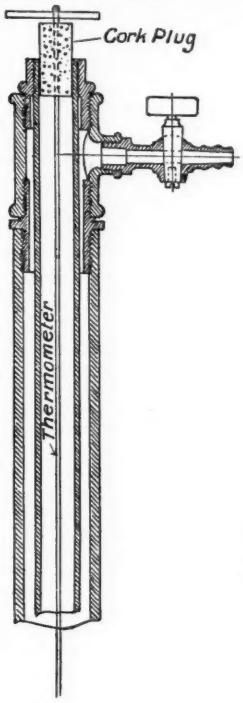


Fig. 2.

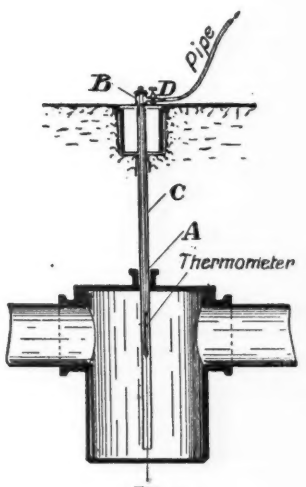


Fig. 3.

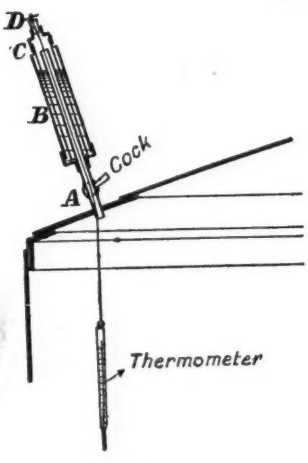


Fig. 4.

effect of this difference in diameter and of the difference in pressure caused by the grounding of the lift are recorded with great minuteness in Dr. Fliegner's original communication.

The pressure of the atmosphere was measured in the ordinary way by means of barometers in the immediate neighbourhood of the works and of the town; small corrections being made for differences in level between the two barometers and the outlet of the blowing engines or the position of the holder inlet at St. Gall. The atmospheric pressures prevailing at the nine different syphon boxes on the main were deduced by a graphic method from the readings obtained at the two ends of the pipe, upon the assumption that the pressures varied regularly with the altitudes. A system of electric bells was provided over the whole main and extending to the two ends of it, in order that all the different readings might be taken simultaneously—numerous men being engaged, under the leadership of Dr. Fliegner, in making the necessary records.

Determination of the General Gas Constant.

The first work undertaken was a determination of the general gas constant—*i.e.*, the value of R in the equation $p\,v = R\,T$. In calculating out the values, the corrected barometric heights were converted into kilogrammes per square metre—*i.e.*, into millimetres of water column—upon the basis legalized in Germany that one cubic metre of ice-cold mercury weighs 13,595·63 kilogrammes. The saturation of the atmosphere at the lower end of the main was estimated with the aid of an August psychrometer; whereas that at St. Gall was obtained by a process of interpolation from the reports of the Swiss meteorological station in the town. Six tests were generally made at St. Gall and three at the works during the progress of each experiment, to ascertain the value of the constant ϵ—that is to say, the weight of the gas in comparison with that of an equal volume of moist air. It was considered more correct to calculate the density of the gas in comparison with saturated air, irrespective of the actual hygrometric state of the atmosphere at the time, because the air used in the experiments remained in contact with water in the seals of the apparatus, and was therefore presumably saturated with moisture. The values obtained for ϵ were finally employed to determine R.

Table II.—*Values of ϵ and R.*

—	Maximum.	Minimum.
ϵ at works	0·4833	0·4666
ϵ at St. Gall	0·5122	0·4769
R at works	63,242	61,078
R at St. Gall	61,906	57,529
Mean values for R over the whole system	62,441	59,737

After averaging the different individual figures obtained during each separate experiment at the two different ends of the transmission main, maximum and minimum mean values for ϵ, and corresponding values for R were found, which are recorded in Table II. herewith. The values for R quoted in the third and fourth horizontal lines of the table were used in all subsequent calculations when conditions at either end of the main were being studied separately. But when the phenomena prevailing at the different points along the main, or over the transmission system as a whole, were involved, the means of the two end values were taken, as shown in the last line; and these means were used in the appropriate experiments. After averaging them for each individual experiment, the figures obtained for R at St. Gall were invariably smaller than those found at the works; so that the gas was always comparatively heavier at the outlet of the high-pressure main than at its inlet. This peculiarity was not due to any irregularities in the rate at which the gas travelled through different parts of the main but to variations in the pressure so established. Indeed, the relationships between the values of R at the lower and the upper ends of the main in experiment No. IV., where the gas travelled at the lowest speed, and in experiment No. VII., where it travelled most rapidly, were practically identical; whereas in experiment No. I, where the speed was slightly greater than in IV., the two values for R differed greatly. The peculiarity was not due to the separation of moisture; for inasmuch as water vapour is heavier than gas, such separation would have involved a decrease in specific gravity. Presumably the increase in density was due to some physico-chemical change—perhaps the removal of lighter constituents by the deposited water, perhaps the partial condensation of heavier constituents during the intervals between the tests, or during the prevalence of lower temperatures; the heavier constituents being afterwards partially volatilized again when the temperature rose.

Measurements of the Volumes of Gas, Etc.

In Table III. are collected, from several of the tables printed by the author in his original communication, the more important data obtained during the six different experiments under pressure relating to the amount of gas passed per unit-time, and per revolution of the blowing engine; also the amount of energy supplied by the motors to the blowing engines, and by the blowing engines to the gas, together with figures showing the efficiency of the whole plant. The Roman numerals in the top line of the table represent the order in which the different experiments were carried out, the order in which they are recorded being that of increasing numbers of revolutions per minute and of gas forwarded per second, as will be seen on inspecting the horizontal lines 3 and 4. The second line of the table shows which of the two blowing engines was employed; the gas in experiment No. I. passing from the lower to the upper end of the forwarding main merely under the impulse given by its own specific gravity. The following lines of the table do not seem to require explanation beyond the statement that the lines marked 6a, 7a, 8a, and 12a have been added by us for the purpose of indicating the British equivalents of some of Dr. Fliegner's metric values. The horse-powers in lines 9 and 10 have been left in their German forms. Engine No. I. used in experiment No. III. began to run hot at the high speed employed during the test. Hence the percentage efficiency during that test, as shown in line 11, came out lower than in the preceding experiment No. VII. Had heating not occurred, the percentage efficiency would probably have shown a still higher value, continuing to rise with increasing speeds of the engine as in the former cases. Experiment No. III. had indeed to be curtailed owing to the heating of the engine.

The whole research did not afford any facilities for judging in what parts of the plant loss of energy took place. Comparing lines 5 and 7 in the table, it will be seen that the pressure on the outlet side of the blowing engine was but little higher than that on the inlet side, so that no serious amount of leakage took place about the engine. Comparing experiment No. IV. with No. I., it will also be seen that a smaller quantity of gas was sent through the main when the engine was running at 36·82 revolutions per minute than when the gas travelled by virtue of its own weight. Examining the figures in line 13, it will be noticed that the efficiency of the same blowing engine decreased with increasing speed, but that the two engines differed somewhat one from the other in that particular. One cause of the decrease in efficiency was doubtless leakage; and since engine No. II. never ran hot, it was presumably more leaky than engine No. I. Another cause for the fall in efficiency may be found in the fact that the gas generally rose in temperature in the engine—giving up part of its heat to the engine. On the other hand, the walls of the engine were constantly raised in temperature by friction. On entering the engine, therefore, the gas was warmed, so that a smaller quantity by weight of it was drawn in than would have been the case if no rise in temperature had taken place. This phenomenon continued until equilibrium was reached between the amount of heat evolved and that lost by radiation. Comparing lines 6 and 8 in the table, it will be observed that experiment No. IV. was exceptional, inasmuch as the gas was hotter on the inlet than on the outlet side of the engine—or, in other words, that the walls of the blowing engine were at first cooler than the gas in the works holder. Hence a condition of thermal equilibrium was not attained during the time of the experiment in question.

Investigations at Different Points along Main.

Table IV. reproduces in somewhat different form the data given

Table IV.—*Length and Rise of Each Section of Main.*

Section.	Length in Yards.	Rise in Feet.
a-b	665	80·8
b-c	898	39·0
c-d	1045	126·0
d-e	1075	141·5
e-f	2300	286·0
f-g	1687	141·5
g-h	2482	61·4
h-i	776	−67·2

in Table I. relating to the nine syphon boxes on the main where measurements of pressure and temperature were carried out. Table IV. indicates the length of each section in yards and the rise in feet; the last section, which includes the final descent from the summit into the town of St. Gall, therefore shows a negative rise or fall. In Table V. are condensed from the very voluminous tables printed by Herr Fliegner in his original paper figures indicating the maximum and minimum pressures found at each syphon box during the progress of four out of the seven

Table III.

1	No. of Experiment.	I.	IV.	VI.	V.	II.	VII.	III.
2	No. of blowing engine	Without	II.	I.	II.	II.	I.	I.
3	Revolutions per minute	—	36·82	53·06	72·35	91·37	103·57	131·47
4	Kilos. of gas forwarded per second	0·1738	0·1530	0·1984	0·2533	0·3068	0·3727	0·4566
5	Inlet side—absolute pressure in kilos. per square metre	—	9,948	9,915	9,942	10,005	9,937	9,971
6	Ditto—temperature in degrees Centigrade	—	23·57	22·05	21·87	24·84	22·82	21·01
6a	Ditto— ,, ,, ,, Fahrenheit	—	74·43	71·69	71·37	76·71	73·08	69·82
7	Outlet side—absolute pressure in kilos. per square metre	—	9,997	10,081	10,233	10,458	10,631	11,066
7a	Ditto— ,, ,, ,, inches of water	—	394	397	403	412	419	436
8	Ditto—Temperature in degrees Centigrade	—	23·39	23·27	24·32	28·74	29·18	30·77
8a	Ditto— ,, ,, ,, Fahrenheit	—	74·10	73·89	75·78	83·73	84·52	87·39
9	Work done upon the gas in H.P.	—	0·186	0·821	1·782	3·432	6·342	12·430
10	Energy supplied by the motor in H.P.	—	3·604	5·052	6·800	10·050	14·428	30·175
11	Percentage efficiency of the whole plant	—	5·17	16·25	26·20	34·14	43·96	41·19
12	Cubic metres of gas forwarded per revolution measured on inlet side	—	0·4617	0·4199	0·3805	0·3728	0·3968	0·3886
12a	Cubic feet of ditto	—	16·3	14·85	13·45	13·17	14·02	13·73
13	Comparative volumetric efficiency of blowing apparatus	—	100	90·94	82·40	80·74	85·93	84·17

TABLE V.—*Effective Pressure at Different Syphon Boxes in Tenths of an Inch Water Column.*

Experiment No.	Close to Blowing Engine.	a.	b.	c.	d.	e.	f.	g.	h.	i.
IV.. .	54·0–56·0	52·4–54·4	33·5–35·8	53·2	55·6–57·4	58·2–63·4	65·8–69·8	63·8–66·6	56·3–57·0	46·1
VI.. .	98·4–103·0	94·4–100·5	91·5–98·4	89·0–95·0	87·5–93·5	87·8–93·0	86·2–92·2	81·1–83·1	61·0	46·1
V.. .	148 0–156·5	146·5–153·5	138·5–147·5	134·2–139·5	128·3–132·5	121·5–123·2	113·5–117·0	99·2–101·5	67·0–67·8	48·8
VII.. .	303·0–317·0	296·0–310·0	284·0–295·0	267·0–279·0	246·0–258·0	227·0–237·0	191·0–197·0	153·0–157·5	83·8–84·6	51·2

TABLE VI.—*Mean Speed of Gas in Metres per Second.*

	a–b.	b–c.	c–d.	d–e.	e–f.	f–g.	g–h.	h–i.	Average.	Average Speed, Feet per Second.
I.	3·139	3·154		3·176	3·195	—	3·192	3·166	3·172	10·40
IV.	2·839		2·849	2·853	2·865	2·883	2·863	2·823	2·858	9·38
VI.	3·742	3·754	3·765	3·776	3·803	3·835	3·814	3·791	3·796	12·45
V.	4·592	4·612	4·631	4·647	4·687	4·736	4·726	4·716	4·684	15·36
II.	5·497	5·523	5·562	5·595	5·657	5·715	5·723	5·721	5·638	18·50
VII.	6·490	6·517	6·559	6·609	6·706	6·819	6·841	6·869	6·714	22·00
III.	7·904	7·975	8·045	8·120	8·283	8·448	8·540	8·676	8·282	27·20

TABLE VII.—*Observed Coefficients of Friction.*

	a–b.	b–c.	c–d.	d–e.	e–f.	f–g.	g–h.	h–i.	Average.
I.. . . .	0·03419	0·01835		0·02778	0·02033	Negative	0·04072	0·01954	0·02080
IV.. . . .	0·02045		0·01928	0·02005	0·01931	0·02691	0·02092	0·03465	0·02217
VI.. . . .	0·02681	0·01658	0·02338	0·02049	0·02096	0·02331	0·02360	0·03362	0·02300
V.. . . .	0·02706	0·01775	0·02362	0·02602	0·01871	0·02250	0·02335	0·02673	0·02254
II.. . . .	0 02164	0·02649	0·01647	0·02440	0·01968	(0·00892)	0·02824	0·02982	0·02382
VII.. . . .	0·02113	0·01546	0·02131	0·01951	0·01756	0·02101	0·02143	0·02658	0·02021
III.. . . .	0·02404	0·02192	0·01442	0·02047	0·01837	(0·01267)	0·02466	0·02510	0·02118

TABLE VIII.

1.	No. of Experiment.	IV.	I.	VI.	V.	II.	VII.	III.
2	Mean speed of the gas.	2 858	3·172	3·796	4·684	5·638	6·714	8·282
3	Mean coefficient of friction observed	0·02217	0·02080	0·02300	0·02254	0·02382	0·02021	0·02118
4	Coefficients calculated by Grashof's formula	0·02155	0·02115	0·02049	0·01980	0·01925	0·01877	0 01825
5	,, ,, ,, Arson's ,, ...	0·02776	0·02742	0·02691	0·02642	0·02607	0 02579	0·02551
6	μ in metric formula	0·7867	0·8091	0·7708	0·7731	0·7505	0·8087	0·7793

experiments; these figures having been translated from millimetres of effective pressure into tenths of an inch water column. The figures relating to the other three experiments have been omitted from the present abstract, inasmuch as, owing to the employment of a solution of zinc chloride in the gauges, some doubt appears to have arisen as to the accuracy of the readings. The individual figures from which Table V. has been prepared show that irregularities in pressure up to about 10-10ths of an inch water column were felt over almost the whole main—that is to say, up to a distance of 5½ miles from Riet. The irregularities, of course, diminished in amount with increasing distances from Riet; whereas original variations of much less than 10-10ths were wiped out at considerably shorter distances. It is worth remarking that some two years before the investigations now being described were carried out, a preliminary test of the main and blowing engines was made. The average pressure in syphon box *a* was approximately 185-10ths; but it exhibited variations up to 13·8-10ths from the normal, which synchronized with the revolutions of the blowing engine. On examining the plant, the engine was found to have settled somewhat on its bed, and had begun to bind at one particular spot. This, no doubt, affected its delivery, perhaps by causing a blade to bend. During the more recent experiments, variations in pressure were also noticed; but both at the point *a*, and at the gauge immediately after the engine, they did not attain one-tenth of their former dimensions. On the other hand, the readings of temperature which were made at the different syphon boxes showed that the gas invariably sank quickly to the temperature of the soil, and that only when the blowing engine became seriously hot was an elevated temperature of the gas to be detected at syphon box *a*—*i.e.*, 100 odd yards from the engine. Table VI. shows the mean speed in metres per second, deduced from numerous observations during the progress of each separate experiment at which the gas was found to be travelling through the various sections of the main. The experiments in Table VI. are put down in the order of increasing speeds of the blowing engines and increasing volumes of gas sent into the St. Gall holder, as was also the case in Table V. The penultimate vertical column of Table VI. contains the average readings relating to the eight different sections of the main, also quoted in the metric data of metres per second; while we have added a final column converting these figures into feet per second.

THE COEFFICIENTS OF FRICTION.

With the aid of the observed pressures and temperatures of the gas at the different syphon boxes, the specific volume of the gas *v*, was calculated from the general gas equation. The arithmetical mean of the values so obtained for each two neighbouring boxes was then deduced and considered as the mean constant specific volume of the gas during its passage through each separate section of the main. From the known weights of gas passing, its mean speed *w* was calculated, as already indicated in Table VI.; and finally the coefficient of friction was worked out by means of the usual hydraulic formula for ascending mains,

$$v\,\delta p = h + \frac{\lambda\, l.w^2}{d\ 2g},$$

where *g* is the metric acceleration of gravity (9·81), *d* the diameter in metres, *l* the length, and *h* the rise of each section of the main in metres, δp the fall in pressure in millimetres of water column, and λ the mean coefficient of friction. The figures thus obtained for each separate section of the main in the seven different experiments are reproduced in Table VII., the last column of which contains the averages. For the section *f*-*g*, the coefficient appeared to be negative in experiment No. I., and much too low in experiments Nos. II. and III. These were the tests in which zinc chloride solution was used in the gauges, and doubtless this solution was responsible for the errors. The figures were accordingly rejected.

The coefficients in Table VII. represent the friction set up by the different sections of the main, or by the entire length of it as a whole; no allowance being made for special amounts occurring locally through the presence of bends, stop-valves, or the numerous other syphon-boxes over and above those where measurements were carried out. An inspection of the table will show that the individual coefficients varied very largely—even those obtained during the course of a single experiment. This irregularity could not have been due to the action of the bends, stop-valves, &c., known to be present in the main; for on making special corrections to eliminate their effect, in the manner employed by hydraulic engineers, fresh coefficients were deduced which agreed among themselves no better. The variations in the original coefficients, however, were too regular to be attributed to experimental errors. For example, in nearly all the experiments the values for λ attained their maxima in the section of the main *h*-*i*; whereas their minima in the more trustworthy experiments Nos. V. to VII., where simple water was used in the gauge-glasses, occurred in the section *b*-*c*. In all probability, therefore, the main instituted an abnormal amount of friction in certain places, owing perhaps to the entry of foreign matter while it was being laid. The last column of Table VII. contains the average coefficients obtained from the individual values in the usual fashion; but in experiment No. I., owing to the uncertainty attaching to most of the readings of the pressure gauges, the dimensions of *w* and λ were deduced from the corrected pressures and temperatures immediately after the idle blowing engine and at the syphon-box *i*. In the best experiments, Nos. V. to VII., the mean coefficients decreased with increasing speeds of the gas, as is the case during the propulsion of air and of water through mains; the other experiments, which did not give parallel results,

merited less attention—Nos. II. and III. because the liquid used in the gauges was the zinc chloride, No. IV. because the pressure was lowest. The experiments were too few in number to allow the relationship between the magnitudes w and λ to be determined more precisely.

Taking the general mean of the coefficients obtained in all the experiments where the gas was forced through the main by a blowing engine, the coefficient of friction became

$$\lambda = 0{\cdot}02215 \text{ (forced draught)},$$

while the general mean of experiment No. I., where the gas had to travel under the impulse of its own gravity, gave

$$\lambda = 0{\cdot}02080 \text{ (natural draught)}.$$

Hence the use of a blowing engine increased the resistance of the main—presumably because the engine did not actually compress the gas. Owing to the absence of compression, each time the outlet side of the engine was in communication with the main, some gas passed backwards from the main into the engine—regular pulsations being established which increased the total friction. The general effect of the Enke blowing engine was thus to increase the resistance established in the main by 6·5 per cent. As it would appear judicious to quote the coefficient obtained when forced propulsion of the gas was employed (in somewhat round numbers), the result of the whole tests may be said to give the value $\lambda = 0{\cdot}025$, which is identical with the factor commonly adopted in making calculations relating to water supply when the liquid travels at similar velocities.

Other Methods of Calculation.—It may be of interest to compare the coefficients of friction deduced in the manner outlined from the experimental data collected during the research with such as are given by the use of various formulæ already published. Based on tests with air carried out by Weisbach, Grashof has proposed the following empirical formula:—

$$\lambda = 0{\cdot}01355 + \frac{0{\cdot}001235 + 0{\cdot}01d}{d\sqrt{w}},$$

where d is in metres and w in metres per second. The results given by this formula are recorded in line 4 of Table VIII., in which Dr. Fliegner's own figures in lines 2 and 3 are repeated from a previous table for ease of comparison. In experiment No. I., where the gas moved under the influence of its ascensional force alone, Grashof's value for λ agreed fairly well with that obtained experimentally; but in the other experiments, where blowing engines were used, his formula yielded coefficients that were undoubtedly too low.

According to an article written by Niemann, in Schmitt's "Der Städtische Tiefbau," M. Arson has suggested

$$\lambda = \frac{\delta g}{1000}\left(\frac{a}{w} + b\right),$$

where a and b are constants decreasing in magnitude with increases in the size of the main, a varying almost in inverse proportion with d, and b more slowly. Taking the values $a = 0{\cdot}000125$ and $b = 0{\cdot}000310$, the results given by Arson's formula are quoted in line 5 of Table VIII. Those referring to experiment No. I. are 1·32 times as great as Fliegner's direct results; in the other cases, they range from 1·09 to 1·28 times too great. Arson's formula, indeed, is already in disrepute.

Employing the usual formula for the volume of gas passing

$$Q = \mu\sqrt{\frac{d^5 H}{\epsilon l}}$$

the values for the metric constant μ deduced from the volumes of gas passing through the St. Gall main and from its average density during the investigation of the system are collected in line 6 of Table VIII. The average of all the figures there given is 0·7826. This is 1·101 times the constant (0·7106) quoted by Niemann after Redtenbacher and Schilling, and 1·175 times the constant (0·6658) actually used by Niemann himself. There is undoubtedly some error in certain of these older constants, inasmuch as they have been calculated from the specific gravity of a gas corrected to standard conditions—*i.e.*, 0° C. and 760 mm. barometer, and from the volume of a gas as drawn from a holder or passed through a meter in other conditions.

In conclusion, it should be said that the St. Gall experiments gave lower coefficients of friction than earlier work on the same subject. To some extent, the apparent decrease in friction may have been due to the methods of calculation employed; but the whole of the difference could not be explained in this way. In all probability cast-iron pipes run smoother inside than formerly; the sockets are smaller, and therefore the finished joints are more level. A great part of the St. Gall main was washed out before being taken into use, and the cleansing operation was presumably beneficial. Moreover, separation of naphthalene was unknown in the main, and perhaps the pipes studied on former occasions may have been slightly blocked with crystals.

The production in Germany of sulphate of ammonia for the year 1906 amounted to some 200,000 tons, which was an increase of about 25 per cent. over the previous year's output; and consequently the importation both into Germany and at Hamburg fell off considerably. The imports to Hamburg amounted to 7646 tons, against 11,602 tons in 1905. The exports from the United Kingdom to Germany amounted to 17,545 tons, compared with 29,009 tons in 1905.

THE ILLUMINATING POWER, IN ORDINARY AND INCANDESCENT BURNERS, OF COAL GAS, WATER GAS, AND MIXTURES OF THE TWO GASES.

By Emile Sainte-Claire Deville.

[**Abridged Translation, with Comments, by W. J. Atkinson Butterfield, M.A., F.I.C., of a Communication presented to the Meeting of the International Photometric Committee in Zurich, July 18 to 20.—Continued from p. 684.**]

The following table presents the more important data of the author's detailed statement, rendered as far as possible into English terms.

Table V.—*Illuminating Duty in the Incandescent Burner of Various Gases.*

Nature of Gas.	Water Gas.				Mixtures in Order of Increasing Calorific Power of										Coal Gas.				Cannel Gas.
	a.	*b.*	*c.*	*d.*	96·2 c. 3·8 j. (1)	89·3 b. 10·7 h. (2)	43·6 a. 56·4 e. (3)	72·2 a. 27·8 f. (4)	71·2 d. 28·8 g. (5)	60·7 b. 33·3 h. (6)	75·0 c. 25·0 j. (7)	38·3 a. 61·7 f. (8)	39·7 d. 60·3 g. (9)	29·2 b. 70·8 h. (10)	50·0 c. 50·0 j. (11)	32·0 c. 68·0 j. (12)	*e.*	*f.*	*g.*	*h.*	*j.*
Density at 0° C. and 760 mm.	0·4816	0·4832	0·4175	0·4196	..	..	..	..	..	..	..	..	..	..	..	..	0·2376	0·3686	0·3780	0·4123	0·6197
Calorific power, water as vapour at 10° C. and 760 mm.	304·5	305·0	306·5	307·6	326·2	336·6	343·1	371·9	378·4	404·7	437·0	454·0	456·0	517·5	567·6	660·1	373·0	546·7	553·8	604·9	828·9
B.Th.U. per cubic foot	2023	2031	2025	2028	2023	2022	1986	2002	2004	2005	2013	1976	1976	1976	2001	1993	1958	1946	1943	1953	1978
Theoretical flame temperature. Degrees Cent.	2·34	2·30	2·26	2·27	2·47	2·65	2·98	3·12	3·10	3·38	3·67	4·08	4·08	4·67	5·09	6·11	3·48	5·16	5·27	5·65	7·92
Volumes of air required for complete combustion of one volume of gas	2·10	2·06	2·11	2·12	2·22	2·38	2·51	2·68	2·85	2·94	3·35	3·54	3·38	4·01	4·39	5·37	2·93	4·57	4·52	4·92	7·16
Conditions affording the specific illuminating duty in the incandescent burner—																					
Rate of consumption (G), cubic feet per hour	8·98	9·04	9·50	8·33	9·40	8·30	8·10	7·49	7·00	7·20	6·22	6·40	6·34	5·86	4·94	4·64	7·88	5·74	5·23	5·23	3·67
Absolute intensity (I), candles	158·6	163·7	186·5	151·7	185·9	164·2	161·9	155·1	155·0	163·1	168·9	147·1	147·2	161·6	164·2	172·9	166·1	155·2	147·8	163·1	174·7
Volumes of air per volume of gas $\left(\frac{A}{G}\right)$	2·10	2·06	2·11	2·12	2·22	2·38	2·51	2·68	2·85	2·94	3·35	3·54	3·38	4·01	4·39	5·37	2·93	4·57	4·52	4·92	7·16
" " as percentage of theoretical volume for complete combustion	89·7	89·6	93·4	93·4	89·7	89·6	84·2	85·8	91·9	87·0	91·3	86·7	80·9	85·9	86·2	87·9	84·2	88·5	85·8	87·1	90·4
Specific illuminating duty $\left(\frac{I}{G}\right)$ candles per cubic foot	17·92	18·09	19·61	18·23	19·78	19·78	19·05	20·70	22·11	22·62	27·30	23·10	23·20	27·54	33·17	37·20	21·04	27·00	28·22	32·00	47·52
" " B.Th.U. per candle	17·23	16·44	15·62	16·87	16·49	17·01	17·18	17·96	17·11	17·89	16·09	19·64	19·65	18·78	17·10	17·73	17·71	20·23	19·61	19·39	17·43

If the values obtained are ranged in groups, and stated in percentages of the corresponding value for neat water gas, the following comparative figures are obtained:—

—	Calorific Power.	Specific Illuminating Duty per Volume of Gas.
Water gas	100·0	100·0
Mixtures 1, 2, and 3	109·8	106·5
,, 4 and 5 and coal gas *e*	122·6	119·4
,, 6, 7, 8, and 9	140·7	131·5
,, 10 and 11 and coal gases *f*, *g*, and *h*	181·9	161·4
,, 12 and cannel gas *j*	243·0	216·0

It will be seen that while the specific illuminating duty in incandescent burners per volume of gas does not vary in exact proportion to the calorific power, yet it varies in the same sense. While the calorific power increases from 1 to 2·43, the specific illuminating duty increases from 1 to 2·16. The duty per unit volume of gas is not quite proportional to the heat of combustion, because the illuminating duty per unit of heat is not quite constant, but diminishes as the proportion of coal gas increases relatively to the water gas in the mixtures. The chief reason for this diminution is probably a corresponding reduction in the theoretical flame temperature. If the figures given in Table V. are rearranged according to the flame temperatures, we get the following grouping:—

—	Flame Temperature.	Specific Illuminating Duty per Unit of Heat.
Water gas	2024° C.	100·0
Mixtures 1, 2, 4, 5, 6, 7, and 11	2010 ,,	96·3
,, 3 and 12, and cannel gas *j*	1986 ,,	61·6
,, 8, 9, and 10, and coal gases *e*, *f*, *g*, and *h*	1961 ,,	88·7

If, further, only the neat or unmixed gases are considered, the following striking table is obtained from the figures quoted in Table V. and others relating to similar samples:—

	Calorific Power B.Th.U. per Cubic Foot.	Theoretical Flame Temperature °C.	Specific Illuminating Duty.		Vols of Air per Vol. of Gas.	Absolute Intensity. Candles.
			Candles per Cubic Foot.	B.Th.U. per Candle.		
Water gas (average)	305	2025	17·95	16·97	2·097	160·8
Very poor coal gas	373	1958	21·04	17·71	2·927	166·0
Poor coal gas	550	1945	27·60	19·93	4·547	151·4
Rich coal gas	603	1953	32·00	18·86	4·953	163·5
Very rich cannel gas	828	1978	47·52	17·43	7·164	174·7

Water Gas Carburetted by Benzol.—The investigation was next extended to water gas carburetted with benzol; and the results of the testings made with such gas may be studied separately. They are shown in the following table (Table VI.):—

TABLE VI.

—	Uncarburetted Water Gas.	Water Gas Carburetted by	
		50 oz. Benzol per 1000 Cubic Feet.	100 oz. Benzol per 1000 Cubic Feet.
Theoretical flame temperature, degs. C.	2023	2033	2044
Calorific power, water as vapour, at 10° C. and 760 mm., calories per cubic metre	2711	3086	3468
Calorific power, B.Th.U. per cubic foot.	304	346	389
Volumes of air for complete combustion of one volume of gas	2·34	2·73	3·12
Conditions affording the specific illuminating duty in the incandescent burner—viz.,			
Rate of consumption (G), cub. ft. per hour	8·79	7·44	6·76
Absolute intensity (I), candles	146·2	144·5	146·4
Vols. of air per vol. of gas $\left(\frac{A}{G}\right)$	2·02	2·44	2·77
Do. do. percentage of air required for complete combustion	86·5	89·3	88·5
Specific illuminating duty $\left(\frac{I}{G}\right)$, candles per cubic foot	16·61	19·45	21·62
Specific illuminating duty, B.Th.U. per candle	18·31	17·83	17·99

It will be seen from this that the illuminating duty obtainable from a unit volume of gas increases in rather greater proportion than the calorific power, and that, consequently, the heat units required to afford one candle decrease slightly as the proportion of benzol in the gas increases. This is not surprising, because, unlike the previous cases of coal-gas mixtures, the flame temperature rises as the proportion of water gas in the mixture diminishes. The flame temperature of benzene vapour is very high (some 2089° C.), and benzol thus increases the temperature of the water-gas flame, whereas coal gas reduces it.

Review of all the Tables.—It may be laid down in conclusion that the illuminating duty per volume of gas varies in proportion to the calorific power, except for a slight elevation or depression depending on the theoretical flame temperature of the gas—that is to say, for all gases having a calorific power ranging up to 2¾ times that of the poorest gas, the illuminating duty obtainable from a given number of units of heat is practically constant, as the deviation of its extreme variations does not exceed 15 per cent.

Minor Part Played by the Flame-Temperature of the Gas.—The author considers it is not surprising that the flame temperature has not a more marked effect on the illuminating duty obtainable from incandescent mantles. In the first place, the theoretical flame temperature is calculated on the assumption that combustion is complete; but, whatever may be the reason, it is a fact that combustion is always incomplete in the case of maximum duty. Further, the true limit of temperature of the flame is lower than that calculated; but it may be assumed to follow the variations of the latter. The most interesting point, however, is that the light of the mantle and the absolute intensity corresponding with the maximum illuminating duty are not determined by the temperature which the flame in which the mantle is inserted can attain, but by the temperature which that flame actually has and retains indefinitely. Now the temperature of the mantle in the case of maximum duty remains far below the limit of the flame temperature; for by increasing the consumption of gas the light of the mantle can be considerably increased. An instance may be quoted in illustration of this. The results shown in Table VII. were obtained with a "Bébé" mantle, Brand A No. 3, by gradually increasing the rate of consumption while always furnishing a supply of air under the best conditions. The gas used was comparatively poor—viz., having a calorific power of 535 B.Th.U. per cubic foot, and an illuminating power such that 4·8 cubic feet of gas per hour were required to furnish a light of one carcel (9·8 candles) in the Bengel burner.

TABLE VII.

No. of Test.	Consumption.	Vols. of Air per Vol. of Gas.	Absolute Intensity.	Duty.
	Cubic Feet per Hour.		Candles.	Candles per Cubic Foot.
I.	1·69	2·29	24·6	14·48
II.	3·18	3·85	69·9	21·98
III.	4·50	4·47	119·6	26·52 *
IV.	5·67	4·33	150·8	26·58 *
V.	7·05	4·24	177·7	25·22
VI.	7·81	4·42	191·4	24·50
VII.	9·86	4·38	227·7	23·08
VIII.	11·28	4·46	244·9	21·70

* Conditions of the maximum or specific illuminating duty.

It will be noticed that the maximum illuminating duty occurs with an intensity of about 150 candles; while with the same gas it is quite possible to attain an intensity of 245 candles. It is evident that in the latter case the temperature of the mantle is much higher than in the former. Thus, under the conditions of maximum duty, the temperature of the mantle is far from attaining the actual theoretical temperature, and, consequently, the calculated flame temperature for the gas used. It will therefore be understood that the variations of flame temperature will only exercise a limited effect on the duty. It is clear that if it had been decided to define the specific illuminating duty as the duty obtained when the mantle attains its highest intensity, irrespective of the consumption of gas, the theoretical flame temperature would play a more important part in the variations of duty. But such a definition would be quite irrational. The object is to settle the comparative commercial value of the different gases; and on this basis the specific illuminating duty ought to be that which affords the maximum light for the lowest consumption.

CONCLUSIONS (of the Second Memorandum).

I.—The author is of opinion that the illuminating power in the incandescent burner, or illuminating duty of a gas, expressed in candles per cubic foot (or equivalent terms) can be defined only in this manner—viz.: The illuminating duty is the maximum value of the quotient of the absolute intensity divided by the consumption $\left(\text{or } \frac{I}{G}\right)$ when a particular chosen mantle is used. When this value is divided by the calorific power (C) of the gas, the value obtained $\left(\text{viz., } \frac{I}{G \times C}\right)$ represents the duty in terms of the heat expended. [In this translation this duty has been stated, in order to obtain numbers greater than unity, as the reciprocal of the above expression—viz., in terms of the number of B.Th.U. expended in yielding one candle.]

II.—It is established that the duty obtained for the expenditure of a given number of units of heat per hour remains constant within 15 per cent. throughout the whole range of illuminating gases from neat water gas to rich cannel gas. The slight variations to which this duty is subject appear connected with the corresponding variations in the flame temperature of the gases. As a corollary, it may be stated that the duty per cubic foot of

gas consumed is very nearly proportional to the calorific power, being subject only to unimportant variations due to the effect of the flame temperature. To fix ideas on the matter, some figures obtained with "Bébé" mantles may be quoted. The duty ranges from an expenditure of 17·6 to 20·2 B.Th.U. per candle. For mixtures of a particular coal gas with water gas, it increases within these limits with increase in the proportion of water gas. The duty per cubic foot of gas consumed varies from 18 candles for neat water gas of 303 B.Th.U. per cubic foot to 47½ candles for a cannel gas of 830 B.Th.U. per cubic foot.

III.—Under these conditions, from the practical and industrial standpoint, it must be granted that the specific or normal illuminating duty in the incandescent burner is proportional to the calorific power of the gas, and the story of the preponderating part played by the flame temperature must no longer be allowed to circulate.

[This brings the author's second memorandum to a conclusion.]

(To be continued.)

SOME NEW APPARATUS FOR CONTROLLING THE MANUFACTURE OF WATER GAS.

In the following lines we give a nearly full translation of an article written by Professor H. Strache, of Vienna, in which the author describes some new apparatus he has devised to enable the process of water-gas manufacture to be controlled more accurately than has hitherto been possible.

Up to the present time there have existed no means whereby the mechanism of the decompositions proceeding within a water-gas generator, the temperature prevailing at different parts of it, and the proportion of steam decomposed, could be continuously ascertained on a large scale. The rules for working a generator generally specify a certain pressure for the air, a certain pressure for the gas inside the apparatus, and a certain time for the "blow" and for the "run." Manifestly, however, according to the resistance offered by the column of fuel to the air, the steam, and the gas, the results of working on these lines must always vary. Hence the water-gas manufacturer should particularly desire to know the temperature in the producer at every moment, and the completeness with which the steam is being decomposed. The small inspection flame often used for the latter purpose is a very imperfect guide, for it really only gives a visible indication when more than 50 per cent. of the steam introduced remains undissociated.

When a producer is being blown, the more carbon dioxide is produced—that is to say, the more perfect is the combustion—the lower the temperature prevailing. In other words, the efficiency of the blow is only high as long as the temperature of the producer is low. The efficiency of the run, on the other hand, depends upon the completeness with which the steam is decomposed; and since this decomposition is the more complete the higher the temperature of the generator, the efficiency during the run increases with rising temperature. The combined efficiency of the blow and of the run is, of course, zero whenever the efficiency of either the run or the blow is zero. Between these two points, the total efficiency of the gas-making process follows a curve whose maximum is attained when the mean temperature of the fuel within the generator lies between 750° and 900° C. When working at such temperatures, the generator gas invariably contains some carbon monoxide as well as carbon dioxide; but if the product is employed for superheating steam, or for heating the fixing chambers in the oil-carburetting process, its presence is of no importance.

The earliest form of apparatus designed by Dr. Strache for controlling the speed of the steam and of the gas is shown in fig. 1. The pipe K, admitting steam to the generator, is fitted with a valve N, and then with a constriction E. From spots before and after the constriction, tubes lead to the two limbs of the pressure-gauge D, which is filled with mercury and which, therefore, shows the difference in pressure obtaining before and after the constriction. Thus the position of the mercury in the "steam" pressure-gauge is a measure of the velocity at which the steam is travelling; whereas the velocity in question can be controlled by means of the cock N. On leaving the generator, the water gas passes to a scrubber where the undecomposed steam is precipitated. The outlet of the scrubber is provided with a second constriction L, which produces the greater difference in pressure in the gas-main before and after it, the greater the amount of gas forced through it. The difference in pressure brought about by the second constriction is indicated in the manner described, by the difference in level in the two limbs of the "gas" pressure gauge M, which is filled with water.

The two pressure-gauges are erected side by side, and, by selecting suitable diameters for the two constrictions, the levels of the two liquids in the gauges can be so arranged as to occupy similar positions upon the scale H when the steam is being completely decomposed—that is to say when two volumes of water gas are being produced from each volume of steam. In these conditions, if any steam escapes dissociation the fact is at once evident, inasmuch as the gas-pressure gauge indicates a smaller difference in level than the steam-pressure gauge. To give an example, if for every volume of steam only 0·7 volume is decomposed and 0·3 volume remains as such, 1·4 volumes of water gas are produced, which, together with the 0·3 volume of undecomposed steam, yield 1·7 volumes of hot gas. Of these 1·7 volumes, 0·3 volume—*i.e.*, 17·5 per cent. is undecomposed steam. Since the two gauges stand at the same level when one volume of steam yields two volumes of gas, since in the example under consideration only 1·4 volumes of gas are passing through the constriction in the gasway, and since the differences in pressure vary as the squares of the volumes compressed, the difference in level indicated by the gas-pressure gauge must be as $2^2 : 1{\cdot}42^2$—*i.e.*, as 4 : 2. That is to say, the displacement of the liquid in the gas-pressure gauge when 17·5 per cent. of the steam eludes decomposition is only half what it is when the whole of the steam is dissociated. The defect of this apparatus is that it leaves too much to the gas maker, who may observe the pressure-gauges somewhat carelessly and may not shut the steam-valve at the right time.

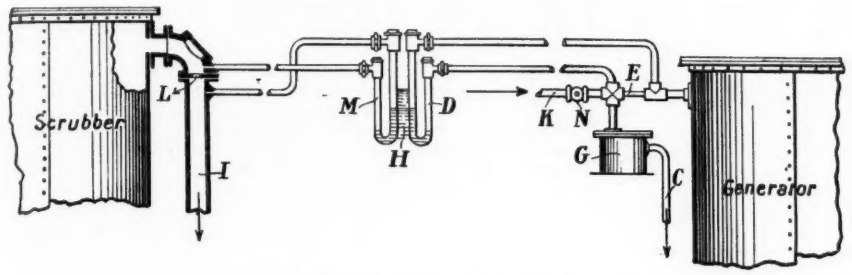
The latter defect is eliminated in the new apparatus—known as a "Dampfschlussmelder" or steam-controller—which is shown in fig. 2, where the letters mostly refer to the same parts as in fig. 1. The steam pressure is maintained at a constant point by means of a governor F; and its value is read off on the manometer M. The velocity of the steam is controlled by means of the constriction K. The gas current is throttled at a point L as near as possible to the holder, where the water gas is stored under constant pressure; and therefore the pressure before L is a measure of the velocity of the gas. The narrow tube A leads through the open cock *a* to the small holder *h*, in which floats a bell that can be loaded as necessary—the cock on the outlet tube *e* being closed. If now, the volume of gas made per unit of time falls below the predetermined minimum, the pressure drops, and the bell *h* falls and causes an electrical alarm to sound. In this manner the gas maker is notified that the steam valve requires closing. The apparatus marked T is the device brought out some time ago by Dr. Strache under the name of the "Autolysator" which serves for the continuous estimation of the carbon dioxide in the gas. At a point after the constriction L, the tube B terminating in the cock *b* leads the water gas to the autolysator T; and the proportion of carbon dioxide in it is recorded automatically on the drum R. The autolysator can also be employed for ascertaining the proportion of carbon dioxide in the producer gas; the cocks *a* and *b* being closed, and the cock *c* on the pipe C (which enters the upper part of the producer at G) being opened.

With the aid of the above-described apparatus the process of water-gas manufacture is carried out as follows: The steam regulator is set so as to give a pressure suitable for the rate at which gas is to be made. The velocity of the steam is caused to be the greater the more gas is to be produced per unit of time. But, as it is not desirable that the temperature in the generator should be kept so high that no undecomposed steam is present even at the end of the run, the bell of the steam-controller is loaded rather less than would correspond with complete dissociation. The gas maker is instructed to open the steam-valve, and see if the steam-pressure gauge shows the right pressure, which is maintained at a constant height throughout the whole of the run. If the temperature in the generator is high enough, the bell of the steam-controller continues to rise from the moment the steam begins to be completely decomposed. Should it not rise, the generator temperature is too low; and the run must be interrupted, and the fuel blown up to a higher temperature.

During the run, the temperature of the generator falls; the proportion of the total steam dissociated decreases; and therefore the pressure before the constriction on the gas-main diminishes. The gas maker is also instructed to stop the run as soon as the electric bell rings. In this way, when the velocity of the steam remains constant, the run is always stopped as soon as the proportion of steam decomposed falls to a certain point. But since the proportion of steam decomposed accurately corresponds with a certain average temperature in the generator and *vice versâ*, the temperature at which the run is interrupted is governed precisely by the steam pressure-gauge and the weight on the steam-controller. Even if different quantities of air are introduced during the blow, and the temperature in the generator at the end of the process is thereby caused to differ, the action of the steam-controller always brings the temperature down to a specified point at the end of the run. But, of course, the volume of gas that is obtained during the run is the greater the higher the temperature attained during the blow. By decreasing the velocity of the gas at the moment when the run is stopped, it is possible to reduce the temperature in the generator; and by increasing the velocity—*i.e.*, by loading the steam-controller—it is possible to raise the temperature. On the other hand, when the steam-controller is loaded with a constant weight, increase of velocity in the steam reduces the temperature in the generator and *vice versâ*.

The proportion of carbon dioxide in the water gas depends on the completeness with which the steam is decomposed; and, therefore, by suitably adjusting the steam-controller, the proportion can be set at the desired point. This is particularly advantageous when the water gas is to be used for industrial purposes (such as welding), for the carbon dioxide seriously reduces the temperature of the flame. With the aid of the steam-controller a good yield of water gas can be obtained, containing even less than 1 per cent. of carbon dioxide.

It should be understood that the steam-controller only governs the mean temperature of those parts of the generator where the steam is being dissociated. The temperature of the upper layers



C Outlet for condensed water.
D Steam pressure-gauge.
E Constriction in steam-pipe.
G Water trap.
H Scale.
I Gas-main.
K Steam-inlet.
L Constriction in gas-main.
M Gas pressure-gauge.
N Steam valve.

Fig. 1.—Strache's Pressure-Gauges for Controlling the Manufacture of Water Gas.

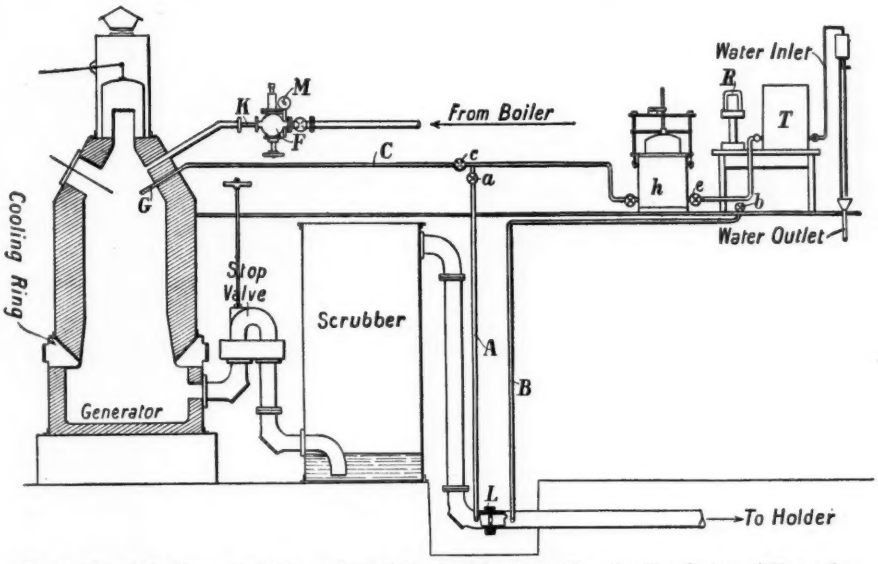


Fig. 2.—Strache's Steam-Controller and "Autolysator" for Controlling the Manufacture of Water Gas.

of fuel and also that of the generator gas depend upon the nature and duration of the blow. To observe the temperature of the generator gas, a pyrometer is put in the flue; and, if desired, the blow may be stopped as soon as it indicates any particular temperature. The temperature of the upper parts of the producer can also be regulated in a similar manner, while leaving it still possible, during the subsequent run, to keep the temperature in the lower parts of the generator at a sufficient height by interrupting the run at the proper time. Indeed with the assistance of the steam-controller and of a pyrometer in the flue, the temperature of the generator gas from plant into which the steam is always introduced from above, can be kept as low as 150° C., while the water gas only contains from 2 to 3 per cent. of carbon dioxide, and the steam is wholly decomposed. The autolysator serves, as already mentioned, to maintain the temperature in the lower parts of the generator at the most advantageous point. If the proportion of carbon dioxide in the generated gas is small, the temperature at the base of the generator is too high, and therefore the load on the controller bell should be reduced. If, on the other hand, the proportion of carbon dioxide is found to be too high, the bell must be weighted more heavily—that is to say, the run must be stopped sooner, at a higher temperature which corresponds with more complete decomposition of the steam.

Experiments with the Author's Apparatus.

Some experiments to ascertain the value of the steam-controller have been carried out in the water-gas plant of the gas-works at Königsberg, where the plant in question belongs to the Strache system and has always worked satisfactorily. After fitting the controller to one of the generators there, the following results were obtained during a twenty-day trial. It was found that: (1) At the end of each run the proportion of undecomposed steam which was formerly from 79 to 100 per cent., had fallen to from 18·4 to 25·2 per cent. (2) The proportion of carbon dioxide had fallen from 4 or 6 per cent. to 2·2 per cent. (3) The gross calorific power of the water gas at 0° C. had risen to 349 B.Th.U. per cubic foot—*i.e.*, was higher than the theoretical value (the excess being due to methane). (4) The consumption of condensing water had fallen to 25 gallons per 1000 cubic feet. (5) The capacity of the producer, which was supposed to be 8840 cubic feet, had increased to 14,450 cubic feet, and the make of gas per long ton of coke had risen from 55,500 cubic feet to 98,500 cubic feet. After a year's trial, the apparatus was also fitted to the second producer—instructions being given that an increase in the capacity of the plant was of primary importance, but that serious alterations in the design could not be allowed. Although the capacity was limited by the dimensions of the gas-main, by the maximum permissible temperature in the apparatus, and by the fact that the temperature and proportion of carbon monoxide in the producer gas must not be increased too much lest the temperature in the chimney should be excessive,* it was nevertheless found possible to increase the make to some 20,000 or 21,000 cubic feet per hour. The output could, indeed, have been raised still further if the chimney had been lined with firebrick and the gas-main increased in size.

Owing to the favourable results of the experiments at Königsberg, a water-gas installation was erected at Itzehoe, where it was specially desirable to obtain gas of high calorific value and the largest possible yield from the fuel without considering the capacity of the plant per unit-time. The apparatus was brought into action at the end of 1905; and, as the result of a fortnight's trial, it was found to make from each long ton of coke 82,000 cubic feet of water gas—having a gross calorific value of 332 B.Th.U. per cubic foot—*i.e.*, to yield a gas containing 121,500 B.Th.U. per pound of coke, equivalent to 83·6 per cent. of the calorific value of the fuel. The net calorific value of the gas was 314 B.Th.U., whereas, in view of the carbon dioxide contained, it should have been only 300 (the excess being due to the methane). The heat balance-sheet of the water-gas process over its fortnight's trial quoted in metric data and in terms of net calorific value was as follows:—

	Calories.	Per Cent.
Sensible heat of water gas and of undecomposed steam	102	2·8
Radiation	15	0·4
Loss by formation of carbon monoxide during blow	616	17·3
Sensible heat in generator gas	158	4·4
Net heat of combustion of water gas	2674	75·1
Heat of combustion of 0·439 kilo. of coke	3565	100·0

When the generator gas was used for steam-raising, the balance-sheet became as follows (gross calorific values being quoted):—

	Per Cent.
Sensible heat of water gas and of undecomposed steam	2·8
Radiation	0·4
Losses of heat in chimney gases and from boiler	13·2
Gross heat of combustion of one cubic metre of water gas	83·6
	100·0

A similar installation for the manufacture of non-carburetted water-gas has been erected at Pirano, which yields a water gas containing only between 1 and 2 per cent. of carbon dioxide. The illuminating power of the incandescent lights employed has thereby been increased by more than 20 per cent. Indeed, the incandescent burners run on water gas give more light per unit consumption than those that are supplied with true coal gas.

* The Königsberg generators were so designed as to be run alternately from above and below, and therefore exhibited a high temperature in their generator gas.

NOVELTIES FOR THE HEATING AND LIGHTING SEASON.

IN THE GAS-HEATING SECTION.

(*Continued from p. 761.*)

Fletcher, Russell, and Co., Limited.

To attempt to describe the extensive variety of gas-fires of a firm of such reputation and standing as Messrs. Fletcher, Russell, and Co., Limited, in a short notice would be to attempt an impossible task. Therefore, we shall confine ourselves to a brief notice of a few of the principal patterns produced specially for the coming season. There has sprung up a demand, and we are not surprised that it should be so, for gas-fires of more attractive exterior than those of a few years since—something of less ponderous appearance, and something that through the eye would give pleasure. It must not be forgotten that a gas-fire, when not in use, has not its radiance and comfortable warmth to sustain it in favour; and therefore a good external appearance is necessary to prevent it becoming an abomination in the eyes of its possessor, and voted a disgrace to its surroundings. Such will not be the case with the new patterns of Messrs. Fletcher, Russell, and Co. Whether we take the "Nubian," the "Rustic," the "Ornate," the "Syrian," or the "Palmyra" fires as examples, our judgment applies. In the "Nubian," we have a production specially designed with the view of meeting the demand for a cheap and yet tastefully cased fire, combining with those attributes efficiency and economy. Finished in the various coloured majolica enamels, the ornamentation is greatly enhanced. It is a fire with a 10-inch wide opening; and it occupies little space in front of the ordinary grate, being only 5½ inches back to front. It is fitted with a patent non-lighting-back burner, and is most economical, being adjusted to consume only 15 cubic feet of gas at 1-inch pressure. The "Rustic" gas-fire is really a complete departure from ordinary lines; and there is originality in its design which will gain for it wide approval. The ornamentation is all in relief; and it takes the form entirely of rustic work. It is indeed a very effective fire. Like all its new companions, it is fitted with a non-lighting-back burner, has a 10-inch fire opening, and measures 7 inches back to front. But for exquisite design, the "Ornate" fire will require some beating. The ornament is in bold relief from a plain ground; and while it looks graceful in ordinary stove enamel, in coloured majolica enamel it will gain admiration in the choicest appointed rooms. This fire also has a 10-inch opening, and is 7½ inches back to front. The "Syrian" fire is one that will be found particularly useful for bed-rooms, nurseries, &c., where a heated flat top, with boiling-ring, is required. The fire opening is here also 10 inches; and the fire measures from back to front 6½ inches. The "Palmyra" gas-fire is similar in design to an ordinary coal register stove. The ornament is chaste and rich; being in the Adam style. It is a handsome piece of work, and is made, apart from the ordinary finishes, in bright brass or copper, or antique copper repoussé casings. It is constructed to suit 36-inch and 38-inch registers. The firm make a speciality of mantels for gas-

The "Nubian" Fire.

The "Rustic" Fire.

The "Arran" Stove.

fires; and this "Palmyra" fire set in one of these mantels, also with Adam ornamentation, must be pronounced a really beautiful combination.

In the "Cathedral" series of heating-stoves (which are intended for entrance halls, shops, offices, warehouses, and well-ventilated rooms), we have an improvement on the firm's well-known "Ruby" series. The firm describe them as giving "a brilliant and pleasing effect;" and the description is not an overstatement. This effect is obtained by the combination of overlays of ruby and embossed glass, and the heating power is greatly enhanced by a number of hot-air tubes, which are placed round the burners, and to which special study has been given so as to obtain the best possible results. They are elegant in design, and therefore applicable to all situations in which such heaters can be used. The "Asia," the "Granada," the "Alhambra," the "Arran" (as illustrated) and the "Canadian" stoves in this series give a range in variety that will gratify all tastes.

Cannon Iron Foundries, Limited.

The Cannon Iron Foundries have sent us a copy of their new season fire-list entitled on the outside cover "The A. B. C. of Buying Gas-Fires;" and these first letters of the alphabet naturally imply "Always Buy Cannon." It is an attractive list, consisting of 24 pages, and is very convenient for pocket or counter use. The list contains a variety of gas-heating stoves of various descriptions, from an artistically designed steam-radiator to a small corridor stove, embracing quite an extensive range of the ordinary ball-fuel type of gas-fires.

Special attention is directed to a few distinctly new lines the firm have introduced this season. In the first place, we have a new series of steam and hot-water radiators of plain design, to afford customers the choice of the plain or ornamental series. The ornamental series, we are informed, has been in considerable demand; and it may be of interest to mention that this type of heater has been recently selected for use in the Queen's Rooms at Glasgow. Then there is a special type of radiator, called the "Radio," which is on distinctly fresh lines; affording as it does a radiator possessing all the essential features for the highest efficiency at a low price. One of its special features is that the loops and boiler are cast in one piece, which avoids the possibility of leaky joints. This feature is covered by a patent. The Company's "Sefton" and "Savoy" fires are of a very choice design; and they are fitted with an improved duplex burner, and with air and gas regulator to each section. A new type of gas-fire, with all modern improvements, is called the "Magic;" and the same

The "Radio" Gas-Heated Steam Radiator.

fire, adapted with boiling-burner arrangement on top for nursery use, has been named the "Dainty." These fires are most up-to-date, and are fitted with air and gas regulators. It is interesting to note in the list an extract from the "Lancet," showing the unique position attained by the "Cannon" gas-fires in the Smoke

Abatement Society's test carried out during last year. The firm have also issued another pamphlet entitled "Modern Bakeries Gas Fuel." This treats of gas-ovens constructed on improved principles, as supplied largely to bakers and confectioners. The

The "Sefton" Gas-Fire.

The "Dainty" Gas-Fire.

list contains a few printed testimonials, showing the undoubted serviceability of the ovens. In the same list is included a pikelet or muffin plate as an article of utility in the same line of business.

Coking Coals.—In the course of his address at the Pittsburg meeting of the Coal Mining Institute of America, the President dealt with the subject of coking coals. He said a careful study of the facts led him to believe that the reasons for some coals coking or submitting themselves naturally and readily to the coking process and furnishing a high-grade coke were as follows: (1) They are in structure largely prismoidal, permitting the free mixing of the particles, diffusion of gases, &c. (2) Their chemical composition is such that they contain not only the fusing and cementing factors in the most favourable proportions, but carry the most desirable elements in those proportions, and the form best adapted to the purpose for which the coke is required. He thought the reasons some coals were not naturally fitted for the coking process, but yielded high-grade coke after disintegration, were these: (1) Their structure is largely of a laminated character; thus presenting obstacles to the free mixing of the particles and diffusion of gases. (2) Their chemical composition is not widely different from those of the natural coking coals; but they cannot adjust themselves to the necessary processes of fusion, cementation, and interchange of position of the different elements that the complete coking process requires, unless the coal has first been disintegrated or pulverized.

IN THE LIGHTING SECTION.

(*Continued from p.* 769.)

Block Light, Limited.

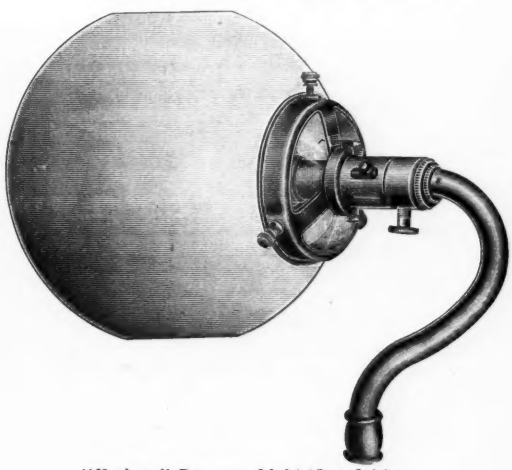
For the coming season we witness a great extension of the enterprise of Block Light, Limited. In the first place, they show us a variety of literature designed to spread light on light, and then they tell us of their business expansions, both in method and goods. The Company's burners, as is well known, are made in two sizes, called the "Standard Block" light and the "Junior Block" light. The high duty of these burners for the consumption of gas, it is pointed out, is due to the scientific construction of every part of the burner itself and the make of the mantle.

The Block Standard Burner.

Anti-Vibro Mantle.

The Block Junior Burner.

"Horizon" Economy Light (Shade Removed).



"Horizon" Economy Light (Complete).

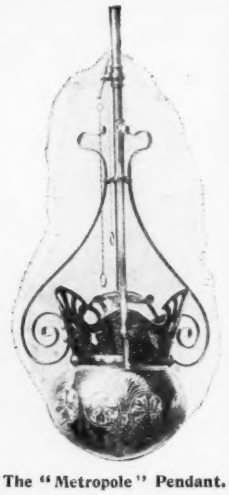
Several new combinations of the burners and glassware have been introduced for this season; and they are very effective. Opal shades coloured tipped at the edges are both useful and ornamental; while combinations with coloured globes of artistic design fit the burners for all positions. The "Junior Block" light

has undergone changes in outer form to constitute it suitable in every way for the most daintily appointed apartment; and the special glassware for it is also highly ornate. The "Block" mantles are now British made with British labour; and a fresh extension of the Company's enterprise is the packing in a sealed box of one of their burners and a Block "Anti-Vibro" mantle (made with a wire supporting frame and gauze inside the mantle instead of on the burner top, so that the gauze is renewed with every mantle), with a three months' guarantee for the mantle. The Company are also making a mantle to fit any burner, under the title of the "Block Economy Anti-Vibro" mantle. A novelty is the "Horizon Economy" light. The illustrations best describe it. It is made with simple regulation of gas and air; and any ordinary looped mantle can be used with it. The illuminating power of the light is stated to be 150 candles. The Company have branched out into the mantle supply business for all vertical and inverted burners, glassware, and attractive silk and lace and bead shades.

G. Hands and Co.

The gas-fittings of a room may make or mar it; and we venture without hesitation to say that the "Modern Art" gas-fittings of Messrs. G. Hands and Co. will add to the refinement and decoration of any room or other position in which they are placed. Their fittings must be seen to be properly appreciated; for they have brought the art of gas-fitting making up to a high pitch of perfection. Gas-fittings may be strong and their finish irreproachable; but when to these merits there is added novelty in design and comprehension of artistic requirement, then we have something which appeals to us as worthy of commendation and acceptation. All this may be said, without qualification of any kind, of the fittings under notice. Our illustrations are merely specimens of a great and charming variety, specially designed for every conceivable situation, which are to be seen at the firm's showrooms in Farringdon Road. Mostly the fittings, whether pendants or brackets, are hand beaten and finished in oxidized copper, and some of them have aluminium insertions which add to their beauty. Particular attention is drawn to the firm's patent bazils (introduced into pendants and brackets), in which family photographs, views, or armorial bearings can be placed. Not only in the metal work but in the glassware of these fittings is art brought into play; for the glassware is made to match the fittings. Pleasing indeed are the designs in opalescent glass, satin-finished etched glass, or etched and tinted glass. The French brackets, finished in gilt, also take the fancy as drawing-room fittings. The growth of the desire for more light has been accompanied by a desire for the displacement of the old plain and heavy fittings by something lighter and more ornate. Here wants may be fulfilled without disappointment.

The "Regina" Pendant.



The "Metropole" Pendant.

The "Jersey" Bijou Bracket.

The "Ritz" French Gilt Adam Lamp.

The "Henley" Bijou Bracket.

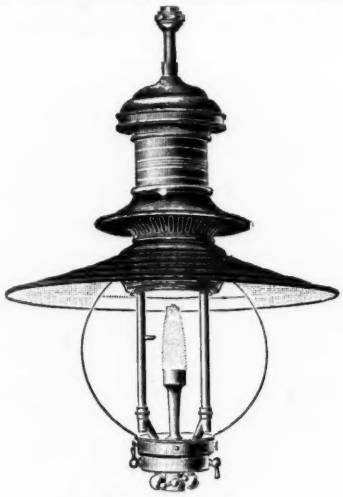
What is known as the "Norwich" system of gas lighting has also been introduced by Messrs. Hands and Co. In its invention, Mr. Thomas Glover, Engineer and Manager of the British Gaslight Company's Norwich Station, and Mr. W. H. Wayte, the District Superintendent, were jointly concerned with Mr. Hands. It was always accounted a convenience peculiar to electric lighting that it could be switched on and off at the will of the user without trouble, matches, or taper. That convenience is not now peculiar to the electric light; for automatic arrangements for distance lighting have long been on the market, and have successfully removed the singularity of electric lighting in this respect. Appropriately, the newest method of gas lighting has been named after the place of its birth; and so is known as the "Norwich" system of gas lighting. One of its greatest recommendations is, next to its reliability, that it is the nearest approach that has yet been devised to the tumbler switch employed in electric lighting. The tumbler switch is fitted in the gas-service pipe between the meter and the fitting, at a convenient place in the room for access. In the case of a complete new installation, main pipes are laid under the ground floor, with connections rising to each switch; and a pipe is then led from the switch to the burner. By piping in this manner, any condensation is drained into the main pipe. When applying the system to existing gas-fittings, it may be necessary for a pipe to descend, and afterwards return from the switch—see "JOURNAL," Sept. 10, p. 703. In this case, it is advisable to fit a syphon (of a form provided) underneath the switch, and connected to the return pipe. Then should condensation take place, it is a very simple matter to drain the pipes. If it is not convenient to chase the pipes into the wall, they can be run in capping and casing, exactly as with electric wires. The auto-igniters are screwed on to the fittings just below the burners. The igniters are adjusted by a bye-pass screw on the tumbler switch until the pilot lights are sufficiently reduced. In the event of any of the pilot lights then being too large, they can be further regulated by a socket screw on the igniter itself. But an important point to bear in mind is that the success of the apparatus depends entirely upon the proper adjustment of the set-screw in the tumbler switch, and not upon the screw in the igniter. Not the least inviting feature of this system is that no unsightly extra tubes or wires are required.

It is not surprising to learn that already the system has attained a gratifying popularity; and many testimonials have been received. This is an example from the proprietor of the Great Eastern Hotel, Norwich (dated as late as the 12th ult.): "I have much pleasure in testifying to the success of the 'Norwich' system of gas installation as recently fixed in this hotel. I have now given it a quarter's trial, *after having the electric lighting entirely removed*, and am very pleased with the change. The unique method of switching on is a great boon." The tumbler switch is one of the best auxiliaries to incandescent gas lighting (vertical or inverted burners) that it has yet been our privilege to welcome. Messrs. Hands and Co. we believe will have a stand at the Manchester Exhibition, so that those of our North of England readers who cannot visit the show-rooms in Farringdon Road, will have an opportunity of inspecting the working of the system at Manchester.

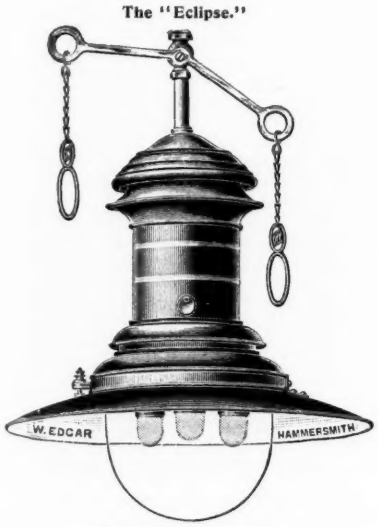
William Edgar.

The latest addition to Mr. William Edgar's apparatus and appliances for lighting is a quite recently patented plant, here illustrated, for high-pressure incandescent gas-lighting. The main feature of the invention is that any pressure can be determined. The relief-valve and tube act automatically as a bye-pass, and come into action after the predetermined pressure is arrived at. The gas is subjected to a churning over and over again. Another principal claim is that the plant is silent; and its compactness, and consequently the smallness of space occupied, cause it to be adaptable to almost any premises. It is simple in construction, and has a duplicate motion—one charge of gas being compressed, while the other is being sucked or drawn into the compressor. The burner used for this high-pressure lighting is cast brass, with a removable top portion of german silver.

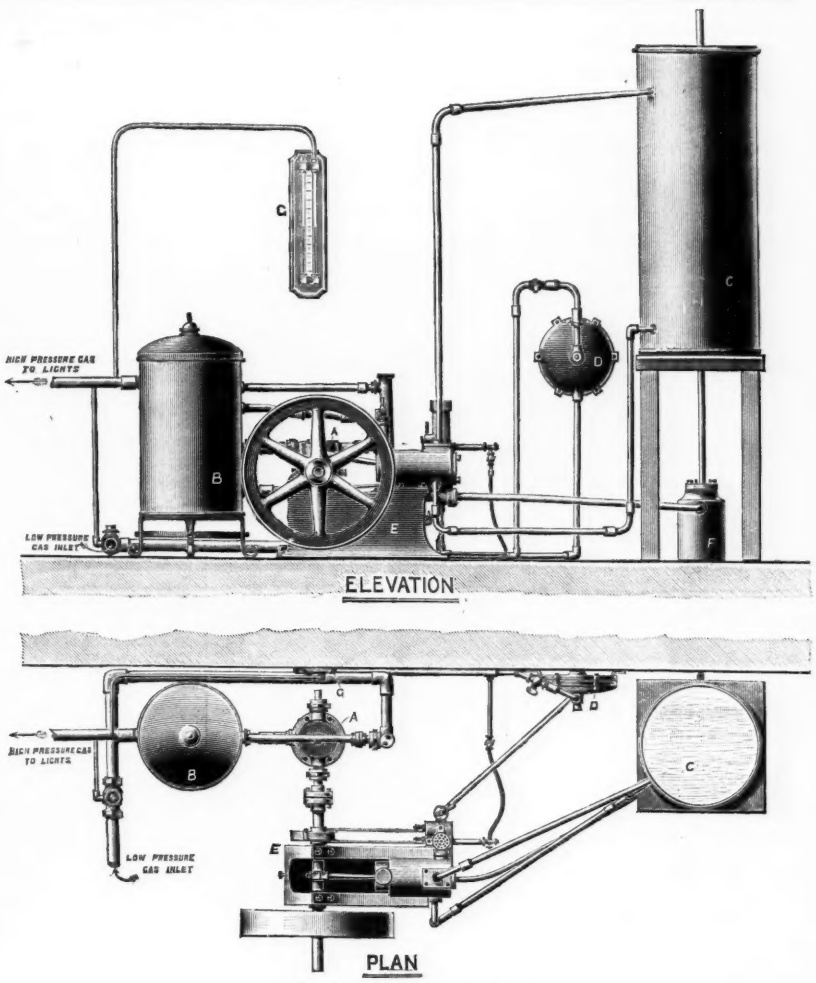
Looking round Mr. Edgar's collection of lamps suitable for every conceivable purpose, we see types that are familiar in low-pressure lighting, but which have now also been constructed for high-pressure work. We may specially mention in this connection the "Eclipse," the "International," the "Caxton," the "Imperial," and the "Mercury" (with a mercury seal anti-vibrator), all for high-



The "Eclipse."



"Eclipse" Inverted Lamp.



Edgar's High-Pressure Plant.

A. Pressure Raiser. B. Container and Governor. C. Water-Tank. D. Gas-Bag. E. Gas-Engine. F. Exhaust Silencer. G. Pressure-Gauge.

pressure lighting. Improvements in lamps for inverted lighting are manifested in the "King" and the "Eclipse" inverted lamps. Profiting by exhaustive experiments, both of these lamps are element-proof, non-lighting back, and impart a high rate of duty. For indoor lighting, Mr. Edgar is showing some fine effects in registered designs. Among them are the "Safety," "Idene," and "Pansy." In another department of work is a hot-water circulating apparatus for gas, which (with the recently patented seal-screw main cock) has distinctive features that the gas engineer will be interested in examining.

United Chemical Works, Limited.

The United Chemical Works, Limited, call attention to their new "Ino Cambric" mantle as their chief novelty for the coming lighting season. The mantle consists of ramie fibre; but the texture, instead of being knitted, is woven by the Company's new patent-weaving machine. The quality of the mantle is credited with being a great improvement. As is seen in the illustration, the weaving consists of a number of close vertical webs, alternating with a web of more open texture. The mantle, we are informed, is impregnated in a far heavier solution (some 50 per cent. more than formerly) of thorium nitrate; and, as all incandescent mantles depend upon this chemical solution for their illuminating power, the stronger the impregnation of the mantles the stronger the light. The new mantles have been tested by the Imperial Technical Laboratory at Charlottenburg; and it is stated that they produce a light of 130-candle power, with a consumption of 4½ cubic feet of gas per hour.

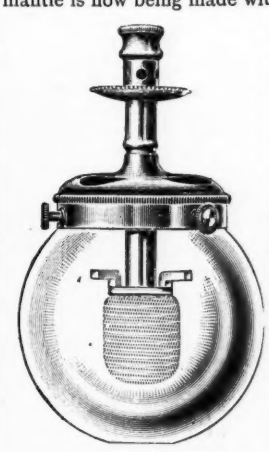
New "Ino" Mantle.

Gasglühlicht Gesellschaft Hamburg.

A new high-pressure mantle is brought to notice by Mr. Ludewig Kappelhoff. It is manufactured of the best ramie; and is made up by what is called Haga weaving. It is of such strong texture that, we are informed, it will stand a gas pressure of some 100 inches. Strength, durability, and brilliancy are the virtues desired in a first-class high-pressure mantle; and these are all claimed for this one. Other advantages of the mantle are that there is no shrinkage, and that the mantle maintains its brilliancy during the whole of its lifetime, which is said to be considerable. The weaving (accomplished by patented machines) is only done by the Gasglühlicht Gesellschaft Hamburg; and the mantle is offered to the trade by the sole agent in London, Mr. Ludewig Kappelhoff. All sizes of upright mantles, for coal, acetylene, and air gas, can be made by this weaving.

J. & W. B. Smith.

This firm have also incorporated several novelties in their large range of lighting goods for the winter season. Their "Glasmi" mantle is now being made with nickel supports, and in sizes to fit the Block "Standard," "Junior" or ordinary "C" burners. Among inverted burners is a neat one of the bijou size, which is named the "Atlas." It is a cheap burner, with a good efficiency. For factory use the inverted light is now reaping a large share of favour; and this is not astonishing, inasmuch as in most works a good downward light is what is required on bench, machine, or other work. Messrs. Smith are offering a new form of fitting provided with reflector, anti-vibrating device, and wire shade to the globe—making a very complete combination for workshops or factories. With old pendants, it is a source of some nuisance to the consumer that they cannot readily be converted from the bottom of the downward tube for the inverted incandescent burner, without scrapping the whole pendant. If someone will get out a series of fittings at moderate price for this purpose, we believe there would be a good demand

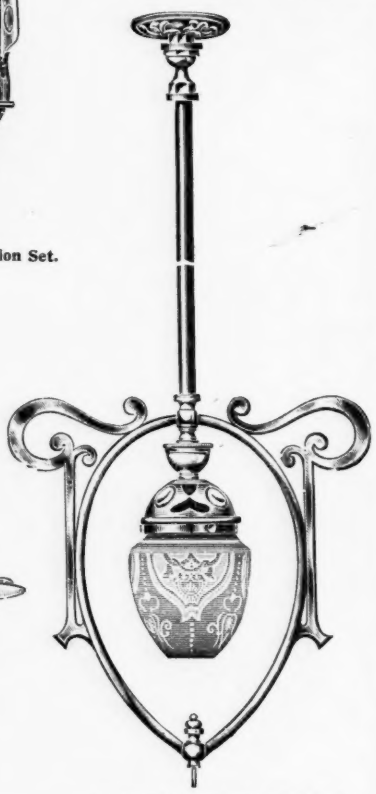


"Atlas" Inverted Burner.

A New Combination Set.

for them. Here we have introduced a pendant which can be used either for an upright or inverted burner at will. Among other goods is noticed a new combination set, comprising burner, mantle opal shade, and chimney. The firm have also now extended their silk

New Factory Fitting.



New Pendant for either Vertical or Inverted Burners.

flounce and opal shades to patterns suitable for use with the inverted light.

The Yorkshire Junior Gas Association will next Saturday pay a visit to Messrs. Stainsby and Lyon's tar-works at Knottingley, by permission of Mr. J. G. Lyon.

A vitrified clay water-main, 12 inches diameter and 3 miles long, has been constructed at Hobart (Okla.), under the direction of the United States Geological Survey. It is made of double-strength pipe, and is subjected to a maximum head of 14 lbs. The joints were caulked with oakum, and run with a mixture of both pure and crude asphalt and petroleum.

An invention by Engineer-Commander Metcalfe, for quickly discharging coal from colliers, was recently tested in Portsmouth Harbour. Its chief feature consists of a grab, which, descending into the hold of the ship, picks up the coal, which, by means of an overhead railway, can be conveyed to any required place ashore, or be deposited in trucks alongside the ship.

A correspondent of the "Ironmonger" recently asked for advice as to the best method of treating a quantity of tar which he wished to make thinner. He said he was aware that this could be done by heating; but he did not wish to use the tar hot. He had tried paraffin without success. In a recent issue, his inquiry was answered by two correspondents who recommended him to use motor spirit, the effect of which would, they said, be that the tar would "dry in an hour, and look as bright as varnish."

The German papers announce the death of Herr Christian Friedrich Schweickhart, on the 7th ult. Herr Schweickhart was born at Offenbach in 1848; received his technical training in the Frankfurt works of the Imperial Continental Gas Association, but migrated to Vienna in 1868; and remained in Austria for the rest of his life. Herr Schweickhart was well known on the Continent of Europe as an inventor of gas governors and cooking stoves; as the compiler of a pocket-book for gas engineers; and as the founder of "Schweickhart's Zeitschrift für das Gas und Wasserfach"—a periodical he edited from 1895 to the day of his death. Herr Schweickhart had been a member of the German Association of Gas and Water Engineers since 1880, and was one of the chief original members of the Austro-Hungarian Association. He was also largely responsible for the introduction of coin-freed gas-meters into Vienna.

EXPERIENCES WITH GAS-ENGINE BREAKDOWNS

(*Concluded from p.* 755.)

We give to-day some further particulars from the annual report of the Chief Engineer of the British Engine, Boiler, and Electrical Insurance Company, Limited (Mr. Michael Longridge, M.A., M.Inst.C.E.), of a year's experience of, among other things, gas-engine breakdowns and their causes.

Instances of the breaking of bolts are given. We will here only refer to one. The engine was a horizontal one, a year old, with cylinder 17 inches diameter by 25-inch stroke, running at 170 revolutions per minute, with lighting gas from a town main. The bolts in the little end of the connecting-rod broke, liberating the rod, which drove the piston into the clearance space, where it caught and broke the air and exhaust valves. The piston and liner were both cracked, and the connecting-rod bent. The bolts were 1 inch diameter, with a cross-sectional area of 0·554 sq. in. at the bottom of the thread. The load upon the bolts due to the inertia of the piston, which weighed 560 lbs., was about 6800 lbs., and the stress upon the bolts about 6250 lbs. per square inch. The stress due to the friction of the piston may have been very small or very large, depending upon lubrication and temperature. As a similar breakage occurred three months previously, just before the engine was insured, the diameter of the new bolts was increased to $1\frac{1}{8}$ inches over the crests of the screw-threads and near the head, and at the middle of the shank for centreing the brasses. Between the enlarged parts the diameter was reduced to $\frac{15}{16}$ inch. Three months later the new bolts broke. The lower one seems to have broken first through the bottom of the screw-thread next the shank. The other broke through the shank after being reduced $\frac{1}{16}$ inch in diameter by stretching. The piston was again driven back into the clearance and broken; the liner was cracked; the air and exhaust valve spindles bent; and the cylinder cracked circumferentially. The connecting-rod also was bent. After these three failures, the bolts were dispensed with, and a solid-ended rod supplied.

Many more examples might be given, but unfortunately they would not make clear why the bolts give way, or how the breakages are to be prevented. At first sight it might be thought that in a four-stroke-cycle engine the connecting-rod bolts would be practically free from stress, since the connecting-rods are in compression during both the explosion and compression strokes, and probably the bolts in the rods of many of the earlier gas-engines were designed with this idea. That such bolts should break, is not astonishing. The pistons and connecting-rods of medium-sized gas-engines weigh about $3\frac{1}{2}$ lbs. per square inch of piston area, and the force required to put them into motion at the commencement of the outward stroke, and bring them to rest at the end of the inward stroke, usually varies between 30 and 50 lbs. per square inch of piston area. At the beginning of the suction-stroke, and at the end of the exhaust-stroke, this force is applied by the crank-pin, and is transmitted through the connecting-rod, putting a tensile stress on the bolts. The friction of the piston during the suction-stroke adds to this inertia stress, and may increase it enormously if the piston be insufficiently lubricated, or become unduly expanded by heat. The inertia stresses on the bolts in the connecting-rods of modern gas-engines usually lie between 3000 and 5000 lbs. per square inch. Having regard to the possibilities of piston friction, it seems that these stresses do not allow sufficient margin. But in many gas-engines the bolts in the big ends of the connecting-rods are exposed to bending as well as to tensile stresses.

Respecting the breakage of bolts through the screw-threads. The difficulty of cutting screws without any error in pitch is well known—in fact, very few nuts have the same pitch as the bolts they are supposed to fit. Thus mutual pressure between the threads of a nut and bolt is not generally the same on all threads. If the pitch of the screw in the nut is longer than the pitch of the bolt, the stress is greatest on the thread furthest from the shank; but if the pitch of the nut be shorter than the pitch of the bolt, the stress is concentrated upon the threads nearest the shank. Obviously, a short-pitched nut on a bolt exposed to tension and shock like a connecting-rod bolt, is a dangerous thing. It tends to cause a fracture separating the nut and bolt completely.

A few other occurrences selected for special mention may be alluded to. Here we find the case of a horizontal gas-engine, six years old, with cylinder 10 inches diameter by 18-inch stroke, running with lighting gas from a town main at 170 revolutions per minute. The air for the cylinder charge was drawn through the framing of the engine, and not through an air-box and pipe, as is usual. When starting one morning, an explosion occurred inside the frame, shattering and blowing away a hand-hole door, and fracturing the frame in several places. The explosion was caused by the ignition of an explosive mixture formed inside the frame by passage of gas past the gas-cock, the gas-inlet valve, and the air-inlet valve into the frame. It is always difficult to ascertain exactly the conditions preceding the occurrence of these explosions. It is evident, however, that there must be pressure in the gas-supply pipe, and that the cock on this pipe must be left open when the engine is stopped, or must be leaking. Secondly, the gas and air inlet valves must either be very leaky, or the engine must be stopped on the suction stroke with one or both of these valves open. Under such conditions, gas can find its way through

the cylinder and air-valve into the air-inlet pipe or into the frame, when, as in the case cited, the air is drawn through the flame. The explosion of the mixture formed may be caused during the working stroke by leakage of flame past the leaky air-inlet valve, or on the opening of the air-valve at the beginning of the suction stroke by flame lingering in the cylinder. It may be said that such combinations of circumstances can occur but rarely. That may be true. But the occurrence of explosions proves that they do occur sometimes; and when they do occur, it is better that the air-pipe should suffer than the frame. Mr. Longridge considers himself justified in advising an alteration of the arrangement when air is drawn through a frame.

An example of another form of defect is in the case of a horizontal gas-engine, five years old, with cylinder 7¾ inches diameter by 13-inch stroke and a speed of 200 revolutions per minute. On finding the engine standing at one of his visits, the Inspector noticed that oil was working out between the fly-wheel boss and the shaft, and that the key did not appear to fit very well. He therefore advised the owner to have the key refitted; and at the same time to carefully clean and examine the boss, particularly the corners of the keyway, for cracks. As he feared, a fine crack was discovered from one corner of the keyway nearly through the boss. It was also found that the keyway in the shaft, which had apparently been cut by a revolving cutter, was not of the full depth throughout the length covered by the boss, and that the key, after being driven for a certain distance, was arrested by an inclined plane, between which and the bed of the keyway in the wheel boss, its point was wedged. So held it could not be kept tight; and constant attempts to make it tight by driving it had no doubt split the boss. The fly-wheels of gas-engines are so frequently found loose by the Company's Inspectors that Mr. Longridge doubts whether the keys used are either deep enough or sufficiently tightly fitted against the driving surfaces of the keyways in contradistinction to the beds. It is also doubtful whether many of the fly-wheels fit their shafts well enough to be held securely by one sunk key. These wheels in very many cases are loose enough to slip easily on to their shafts when the engines are erected at the purchasers' works. If shafts were always bossed-up to receive the wheels, and if two keys of a thickness more nearly equal to their widths than to half their widths were used, there would probably be less trouble with the keys.

The report includes a little admonition on the subject of bearing oil-cups. These are generally small, sometimes difficult to get at when the engine is running, and often neglected. Ring-oilers, in Mr. Longridge's opinion, would be much better, and ought to be adopted. Then many deposit accumulations are noticed; a case in illustration being a horizontal gas-engine, ten years old, with cylinder 16 inches diameter by 20-inch stroke, running at 160 revolutions per minute with lighting gas from a town main. In November, 1905, the cylinder end fractured, and was replaced. In November, 1906, the new end cracked. The cause was overheating, due to the accumulation of deposit in the water-jacket. The owners had been repeatedly advised to keep the water spaces clear, and professed that they were careful to do so—in fact, the Company's Inspector was informed that the jackets had been cleaned five weeks before the crack was noticed. Yet, when the end was taken off and broken, the whole of the heated surface was found coated, and the water spaces round the exhaust-valve chamber were completely filled with lime. Pieces of deposit ⅜-inch thick were removed from them. The case clearly proves the necessity for providing mud-holes in the jackets of the cylinders of gas and oil engines. The Company have urged this necessity for many years, but have been met by the argument that as the water never did attain, or ought never to attain, a temperature high enough to cause deposition of lime, mud-holes were not required. There is no doubt, however, that hard waters do deposit lime and dirty waters mud, and that provision should be made for removing both. Happily, the necessity is now being recognized, at least in the case of large gas-engines. Small ones, however, are still turned out in great numbers without any convenient means being provided for cleaning out the jackets of the cylinders.

It is not always, however, through overheating from accumulation of deposit that the ends of the cylinders of gas and oil engines crack. They are often found quite clean when broken up; and the breakages can only be attributed to stresses set up by some unequal expansion of the castings under ordinary working conditions. Here is a case in point. A horizontal gas-engine, two years old, with cylinder 17 inches diameter by 24-inch stroke, running at 200 revolutions per minute with town gas. The engine drove a dynamo. In November, 1905, the original cylinder end was replaced by a new one, with less clearance, in order to increase the compression to about 135 lbs. per square inch. In March, 1906, the new end cracked through the metal separating the water-jacket from the clearance space, and it had to be replaced. A year later, the third end failed in a similar way. Other cylinder ends exposed to similar temperatures and pressures have lasted much longer. As the castings are presumably made from carefully selected iron chosen by experience by each maker, Mr. Longridge is inclined to think that there must be some want of definite knowledge respecting the temperatures at which the metal should be run, and the conditions under which it should be cooled. Simplification of the castings, and abolition of flat rectangular surfaces and angles of 90°, is very desirable; and this, it is a source of satisfaction to note, is now being carefully attended to.

USE OF THE DE BROUWER RETORT CHARGING AND DISCHARGING MACHINE.

A recent issue of the "Journal für Gasbeleuchtung" contains the text of a paper read by Dr. J. Becker, of Frankfurt-on-Main, before the last meeting of the German Gas Association, in which the author gave an account of the experience he and other gas engineers had gained in the use of the De Brouwer charging and discharging machines.

According to the author, the introduction of machinery into a retort-house invariably reduces the amount of labour requisite, although the precise number of men whose services can be dispensed with, must depend upon local conditions. For example, the gas-works at Kaiserslautern formerly required nine men to manipulate every six retorts, but are now only employing five men to manage the machines that charge and discharge ten retorts. The works at Lichtenberg, near Berlin, employed eighteen men in twelve-hour shifts to make 350,000 cubic feet of gas, but now require only nine men in an eight-hour shift for the same purpose. Similarly, when 500,000 cubic feet of gas were made, the stokers numbered twenty-two; but now twelve men suffice for an identical output. Moreover, the work involved in attending to the De Brouwer machines is much easier and more healthy than that required where everything has to be done by hand.

In the second place, the use of machinery renders the charging and discharging operations more rapid than was possible heretofore. An 11 ft. 6 in. retort may be charged by two experienced stokers with 400 lbs. of coal in 80 seconds; whereas one man can charge it mechanically in from 8 to 10 seconds. Since the retort thus remains open for about two minutes less during the combined charging and discharging operations, a notable economy of gas is attained. The large quantity of smoke and dust produced may seem to signify a considerable loss of coal and gas; but this is not necessarily the case, and if the coal is not broken excessively small, serious waste does not occur. Unfortunately, gas coals are now being supplied, especially those, said the author, which come from England, containing a very large proportion of fine dust.

In the third place, the coal is charged into the retort with the aid of a machine far more uniformly than is possible when the operation is performed manually; and it must come as a surprise to any gas engineer who has had no previous experience on the subject to see how regularly a 15-feet retort is filled with coal by the De Brouwer charger. The coal, indeed, looks as if it had been smoothed with a rake. It is hardly necessary to say that such regular distribution of the coal makes for gas of high quality and yield. In conjunction with the greater rapidity of charging and discharging, the better distribution of the coal leads to so much higher a yield of gas that in one particular place where the coal employed was giving 10,050 cubic feet per long ton when charged by hand, the make rose to 10,450 feet when machines were laid down. On one occasion, Dr. Becker charged each of twenty-seven retorts by hand with 400 lbs. of coal, heated them to about 2124° Fahr. for 5½ hours, and measured the quantity of gas. On repeating the experiment under exactly identical conditions with the aid of the charging machine, and using the new Le Chatelier pyrometer mounted in quartz glass to observe the heat, he found that the make was much higher.

As the coal that is to be charged by machine has to be broken to a smaller size than that put into the retort by hand, the use of such high retort temperatures as 1300° C. (2370° Fahr.) encourages the production of retort carbon, thick tar, naphthalene, and ascension pipe stoppages. It is, therefore, desirable to work at a rather lower temperature, especially when the coal is small, and more particularly still when using English gas coal of small size. For the purpose in view, it is advantageous to mix English coal with German. Engineers sometimes say that high retort temperatures and a long carbonization period are desirable when the discharging machine is employed. This, however, is incorrect, provided the machines are worked properly. It occasionally happens that the coal is not so well carbonized at cooler parts of the retort (where, for example, it is supported on fire-bricks), as elsewhere, or that at the front lid it sticks together in large lumps. In such cases the coke can quite well be discharged by causing the machine to deliver a second or, if necessary, a third blow.

Eastern Counties Gas Managers' Association.—As already briefly announced in the "JOURNAL," the thirty-eighth general meeting of the Association will be held at Gravesend on Thursday next, the 26th inst. The party will assemble at the Clarendon Hotel, where, by the kindness of the Chairman and Directors of the Gravesend and Milton Gas Company, they will be entertained to luncheon. Brakes will then convey the visitors to the gas-works, which will be open for inspection. The business meeting will be held in the Masonic Hall; and afterwards dinner will be served at the Clarendon Hotel. The following day, a drive through Dickens's country to Cobham Hall (which will be open for inspection by permission of the Earl of Darnley), and from there to Gad's Hill, has been arranged for. Beyond the formal business, the only item on the *agenda* is the delivery by the new President (Mr. Joseph Davis) of his Inaugural Address.

GAS-WORKS EXTENSIONS AT MONIFIETH.

In view of the rapidly-increasing consumption of gas at Monifieth, the Town Council recently asked Mr. A. Morton Fyffe, Assistant Engineer at the Dundee Gas-Works and Consulting Engineer to the Monifieth Council, to furnish them with a report on the works, and the necessity of alterations and extensions thereto. The Council met last week to consider the report, and decided to adopt Mr. Fyffe's scheme, and to proceed now with the first part recommended—namely, the erection of a gasholder of 50,000 cubic feet capacity, prepared for telescoping, and the provision of a 10-inch main governor and a cart steelyard. The cost of this work will be about £2000. In proposing that these extensions should be carried out, Bailie Fenton, the Convener of the Gas Committee, pointed out that during the few years the works had been under the control of the Council the consumption had increased from 5 to 7½ million cubic feet.

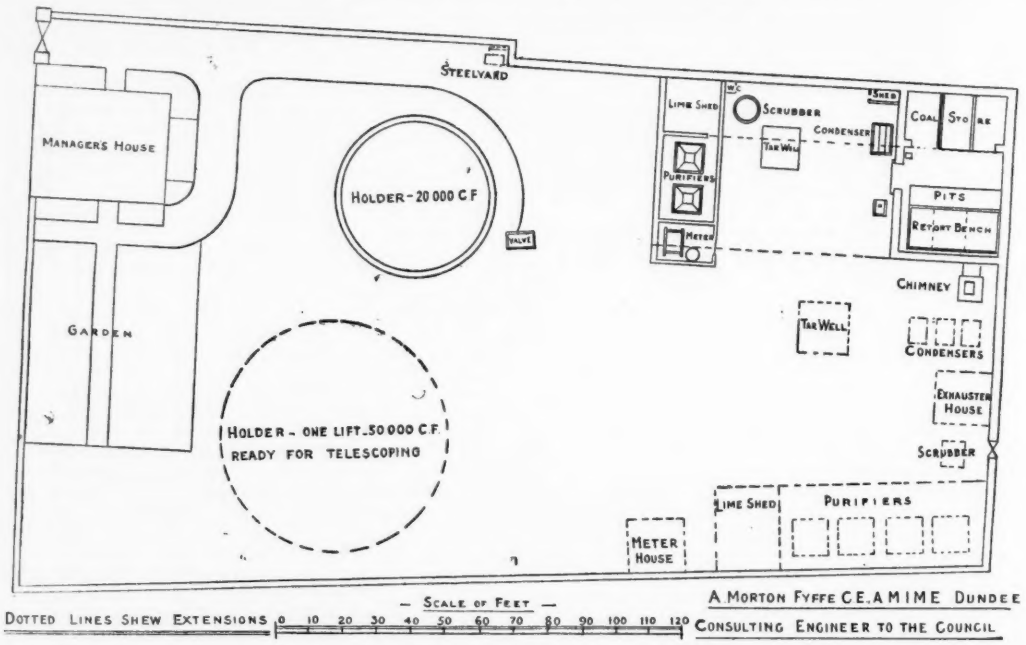
In the course of his report, Mr. Fyffe said he had considered the questions of extensions, alterations, and additions to the existing plant; and after taking into account the increasing consumption of gas and the obvious growth of the town, he had come to the conclusion that in the next few years it would be absolutely necessary to extend and add to the whole of the existing plant, and also to add new appliances. It was impossible to undertake all this at once; but in order that the various works should form a complete scheme, he had drawn up the following proposals, which are shown on the accompanying plan. Before, however, doing this, it was necessary to fix the capacity of the works when completed; and as the present demand during the heavy load time in winter was between 30,000 and 40,000 cubic feet a day, he had based his scheme on an output of 100,000 cubic feet a day. Thus the plan submitted obviated the necessity of extending the ground area of the works until a maximum daily consumption of 100,000 cubic feet was attained. Mr. Fyffe then gives the following outline of his proposals.

Retort-House and Coal-Stores.—The scheme provides for the retort-house and coal-stores being extended westwards to the west wall of the existing purifier shed. The purposes of this arrangement are: (*a*) Utilizing the existing buildings. (*b*) Utilizing the existing chimney. (*c*) Obviating the need of extending the ground area. (*d*) Having the coal-stores next the railway, in the hope of having a siding constructed in the future. As will be seen from the plan, the condensers, tar well, scrubber, purifiers, meter, &c., are at present on this site; but they would be re-erected on the new positions shown. This arrangement is the cheapest one for the extension of this part of the works; the west wall of the present purifier-shed being used, while the stones obtained from the west gable of the retort-house could be used in the new portion of the south wall.

Steelyard.—A cart steelyard is required to check the weights of coal, &c., entering and leaving the works, and should be placed as shown west of the extended coal-store.

Condensers.—The existing condensers would be removed to the new position indicated, and added to as required.

Exhauster, Engine, and Boiler.—The scheme provides for a gas-exhauster, driven by a steam-engine, and housed as shown in a brick building on the east wall. The relative steam-boiler would be placed in the extended retort-house, so that it could be attended to by the man in charge of the retorts.



Extension Plan of the Monifieth Town Council Gas-Works.

Scrubber and Washer.—The existing scrubber is now too small for present requirements, and would be replaced by a modern type of scrubber-washer. The present scrubber would then be sold to some smaller works.

Purifiers.—There are at present two purifiers, each 8 feet square, which are too small for efficient and economical working with the existing load. These would be sold, and a set of four, each 10 feet square, obtained (second-hand if possible), and placed at the south wall as shown. This arrangement would give 400 superficial feet of purification area, as compared with 132 superficial feet now. Little expense would be incurred in housing the new purifiers; a light iron roof carried on girder uprights being all that would be required.

Meter.—The existing meter, which was installed last season, is of ample capacity for the load contemplated; but at the completion of the scheme it would be housed in a brick erection, situated at the south wall as indicated. This house would also accommodate the governor-tank and regulating bell and gauges, described later under the heading of "Governor."

Gasholder—Gas-Storage Accommodation.—The existing gasholder has a capacity of 20,000 cubic feet, which is about 12 hours' supply during load time. This storage is, of course, totally inadequate for present demands; and so long as this remains the only storage accommodation, very serious responsibility and risk are being undertaken by those in any way responsible for the gas supply of Monifieth. While some parts of the works extension might be postponed, the question of storage offers no alternative. The scheme therefore provides for additional gas storage, by the erection of a holder with steel tank; the gasholder being in one lift, about 60 feet diameter by about 18 feet deep, and giving a capacity of 50,000 cubic feet, and so constructed that another lift could be added when required. It would not be advisable to increase the capacity of the present holder by adding another lift. Moreover, the works would still be in the undesirable position of having only one holder, which even then would not be of sufficient capacity. I would recommend that this proposed gasholder be on the girder-column system, externally guided, and independent of any cables or chains, in consequence of the position of the works, where high winds are experienced.

Governor.—The present governor on the main-outlet to the town is quite useless for the increasing consumption; and it will be necessary to introduce an efficient and modern type, to control the pressure on the outlet. This governor would be fitted at the outlet of the gasholders, while the tank, bell, and gauges would be housed in the new meter-house. Meantime, however, this would be placed in the present meter-house; and when the new meter-house is erected, it can be easily transferred by simply lengthening the lead air-pipe.

As already stated, it is impossible to undertake all this work at one time; and it could be arranged to divide it over (say) three or four years. But there are some parts of it that must be proceeded with at once—namely, the gasholder, governor, and steelyard. For the purpose of having a stock of coals on hand, and ensuring that the coals be dry when put into the retorts, it is proposed that, as a temporary arrangement, a light iron roof be erected between the present retort-house and the tar-well, to form a coal-store of a capacity of about 70 tons. The works which are recommended to be proceeded with now would be specified in the autumn, so that they could be manufactured in the contractor's workshops in the winter, during the slack season, which would give the advantage of low rates; and they would be erected at the gas-works in the early spring of 1908.

REGISTER OF PATENTS.

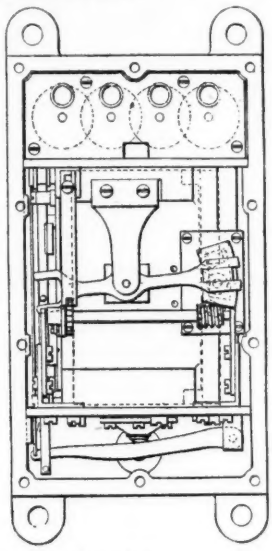
Liquid Meters.

CAHILL, D., of Paris.

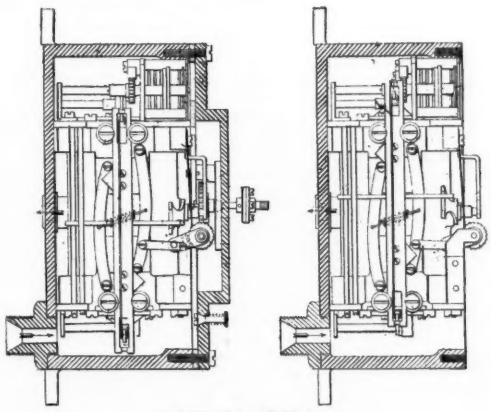
No. 18,513; Aug. 17, 1906.

This invention relates to liquid meters of the class described in patent No. 18,511 of 1906; the object being "to simplify the construction of such meters, to render certain of the parts more positive in operation, and to reduce the friction of the working parts."

The invention consists in actuating the counting and indicating mechanism and the slide-valve in such a manner that the work involved in actuating the former and in giving the latter its initial movement is done positively from the movement of the piston controlled levers, whereby the spring which acts on the levers engaging the cams of the shuttle-bar is relieved of all work other than that of rapidly completing the throw of the slide-valve.



The illustrations show a plan of the meter with the cover removed; and (to a smaller scale) side sectional elevations of the meter, showing the shuttle-bar in its two extreme positions.



Cahill's Liquid Meter.

The invention further consists in arranging the shuttle-bar so that, although its initial movement is positively effected by the piston controlled levers, it may, under the action of a caliper or like lever spring, have considerable free movement along its normal path in relation to the piston controlled levers, and in connecting these last two levers together independently of the shuttle-bar. By these means, the movements of the piston controlled levers are reduced to a minimum in relation to the movement of the shuttle; and by connecting the levers together there is overcome, during the positive movements of one piston-rod, the frictional resistances of the other piston-rod and the counter pressure of the liquid at the back of the diaphragm of the other rod in returning to its initial position.

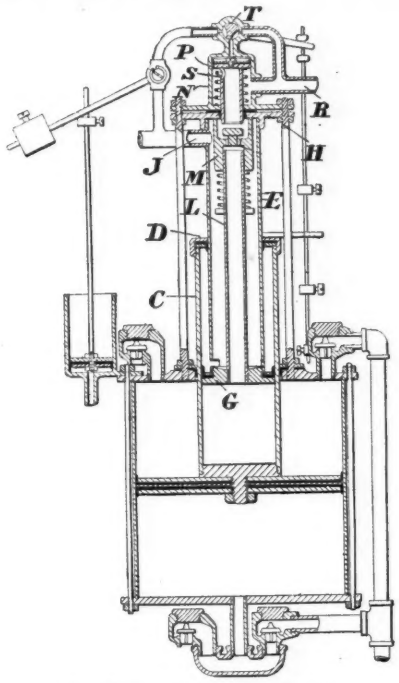
Among other objects aimed at are: (1) Pivoting the levers which engage cam-surfaces on the shuttle-bar at opposite ends of the cylinder to each other—the cams being correspondingly changed in position, so that the force exerted by the spring controlled caliper levers upon the shuttle shall be the same in either direction. (2) Forming the discharge port of the slide valve very small in relation to the two side or inlet ports, and arranging the slide valve so that, in its mid-position, both side ports are slightly uncovered, whereby the tendency of the slide valve to bind upon its face (as where a rapid discharge of liquid takes place) is avoided, and friction is consequently much reduced. (3) Operating the indicating mechanism through a worm, the shaft of which is rotated from a ratchet wheel and pawl controlled from a caliper lever or other positively actuated part; the worm being arranged to gear with a worm wheel (mounted after the manner of a free-wheel) upon a spindle provided with a valve face and passing through a separating partition—the spindle having upon its other end a pinion gearing with the indicating mechanism. (4) Means for locking the valve against movement under vibration or the like.

Gas-Pressure Raisers.

GOODRIDGE, R. H., of Upper Tooting, S.W.

No. 19,484; Aug. 31, 1906.

This invention relates to gas or air compressors actuated by water pressure, and is particularly suitable for compressing air to supply heating gas-burners—"being even in action and capable of being operated by a low-pressure water supply or for supplying gas at a pressure greater than the ordinary gas supply."



Goodridge's Gas-Pressure Raiser.

With the apparatus shown, water is supplied from the main, through the pipe J, to the interior of the tube E passing into the upper annular chamber of the piston-rod C, acting between the upper head D of the rod and the piston G, and so carrying the main piston-rod and its piston upwards and compressing the air above the latter. The main piston-rod having reached the upper end of its travel, operates (by tappet action) the cock T, which brings about communication between the main water supply and the upper surface of the piston P, and tends to force it down together with its tubular piston-rod, which latter contacts with the valve face on the sliding valve M and closes the exhaust way through the ports R S, and by a continued movement forces the valve M off its seat. This being formed with perforations extending from its upper surface to the part of its lower surface located above the end of the tube L, the water from the supply passes through the valve M and down the tube to act within the lower chamber of the main piston-rod C and force the main piston downwards, so as to compress the air beneath it. Upon the main piston reaching its lower position, the tappet action takes place and changes the position of the valve T to exhaust, and the piston P is immediately lifted by its spring, raising the valve seating of its tubular rod and permitting the sliding valve M to contact with its seating on the closing plate H; thus closing the water supply to the tube L, and therefore to the lower chamber of the main piston-rod C. Then as the main piston-rod rises, the water in its lower chamber exhausts up the central tube L and through the perforations in the sliding valve, passing through the open end of the small piston-rod and out through the ports S R.

When the air pressure generated either in the supply pipes or a reservoir reaches some predetermined limit, it is desirable to throw the machine out of action until the pressure has been reduced, and to this end a regulating piston is provided in a stationary cylinder; the lowest end of the latter communicating with an air reservoir or supply pipes. The regulating piston actuates, by means of a rod, a cock in the supply pipe from the main which supplies the valve at the upper end of the small cylinder N, so that the piston-rod of the regulating piston cuts off the supply and the apparatus becomes stationary, because the water supply is stopped to the surface of the piston in the cylinder N.

Gas-Engines.

MARKS, E. C. R.; a communication from the SOUTHWARK FOUNDRY AND MACHINE COMPANY, of Philadelphia, U.S.A.

No. 19,539; Sept. 1, 1906.

This invention relates particularly to the valve gears of gas-engines—having for its object to simplify and make more accessible the valves and valve actuative mechanism of such engines. Important features of the invention are the actuation of both the admission and exhaust valves of double acting four-cycle gas-engine cylinders by two cranks set at 90° apart and revolving at one-half the speed of the main shaft; each crank being connected to an admission valve at one end of each cylinder and an exhaust valve at the opposite end. For the best

effects, the cranks directly act upon and reciprocate a series of cams by which motion is given to the valves; and, by preference, the cranks give motion to two parallel reciprocating rods to which sliding cams are attached. The cams actuate rocking levers, which in turn actuate the valves; and it is an important feature of the invention that the admission valve casing should be situated above the cylinders, the exhaust valve casings at the side and at the bottom of the cylinders, and the cams above the exhaust valve casings.

Inverted Gas Lamps and Burners.

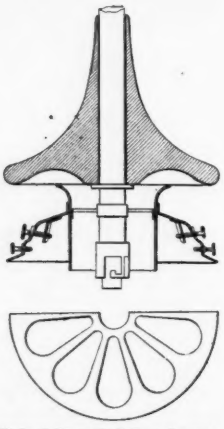
HELPS, GEORGE, of Nuneaton.

No. 23,804; Oct. 26, 1906.

This invention refers to heat diffusers in combination with draught inducers and globe and shade holders for incandescent inverted gas-burners.

One of the chief features in the invention is the splitting-up of the products of combustion and diffusing them over a large area. In ordinary practice, says the patentee, the products of combustion are allowed a free exit in any direction, or if in one direction the area of the outlet is so large that unconsumed gas escapes into the room and the burner is easily affected by draughts. This invention provides for the control of the waste gases and the exclusion of flies, dust, and the like from the globe.

The products of combustion are conveyed into a space or chamber (or several spaces or chambers) having connections with the globe, chimney, or draught inducer on the one side and connections with the atmosphere on the other; the outlet connections being so arranged that the burner may be lighted at them.



Helps' Inverted Gas-Lamp.

One form of diffuser (shown) is that in which a china cone has many indentations or hollows in its base—thereby "presenting a large area to the products of combustion which escape from the burner and which retains sufficient heat from the products of combustion that it is able to consume any carbon that may have escaped complete combustion at the burner." Or the diffuser may consist of a hollow perforated shell of metal or other suitable substance provided with an inner disc or partition.

In conjunction with the heat diffuser, a cylindrical draught inducer or chimney, to which the holder for the shade and globe can be attached, may be secured to the burner-tube by a bridge having its centre screwed so that it may run on a thread cut in the burner-tube. Thus the waste products are confined to the draught inducer until they reach the indentations in the heat diffuser, when they escape into the room through the whole or part of the circumference of the heat diffuser in very small streams.

Photometers.

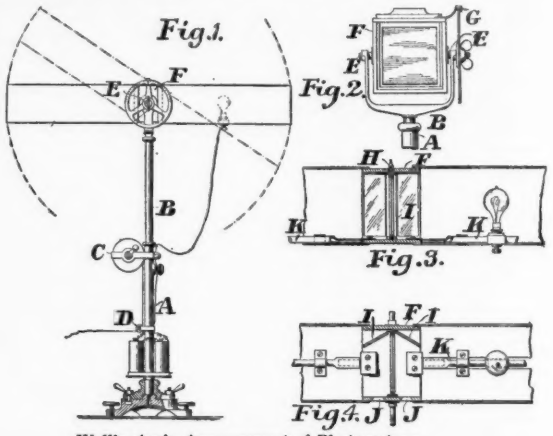
WELLINGTON, S. N., of Maida Vale, W.

No. 6316; March 15, 1907.

The object of this invention is to provide means by which the intensity of light received upon a surface from one source can be compared with the intensity of light received upon the same surface from another source, and the efficiency of the sources of light, so tested, easily compared by an arbitrary standard. At the same time, the invention aims at constructing apparatus that, while it can be used "to obtain a quick and ready approximation of the differences in intensity of the light from various sources, yet is capable of being fitted with additional devices converting it thereby into a simple and portable photometer."

There is provided an open-ended tube, rectangular in cross section and not of great length compared with its diameter—that is, it may even be less in length than its diameter—and fitted to receive a frame to carry a sheet of printed matter in a plane extending transversely of its axis. The tube is carried upon horizontal trunnions extending at right angles to the axis, the frame being fitted with means whereby any angle which the axis of the tube is made to assume relatively to the horizontal plane can be ascertained, and means being provided by which the tube can be clamped at the angle to which it has been set. The stand is further provided with a measuring tape by which the distance of the axis of the apparatus in a horizontal direction from the source of light can be measured; and then if the source of light which is being tested requires the tilting of the tube, the distance of the printed matter in the tube from the centre of the light being tested can be readily ascertained by calculation—the base of a triangle being given by the linear measurement so taken by the tape, and the angle of the hypothenuse corresponding to the angle at which the tube is placed relatively to the horizontal plane.

If the letter-press on the sheet which is to form the standard is such that with normal eye-sight it can be clearly read with the light from a source at a specified and known distance, then it is obvious, the patentee remarks, that a printed sheet having precisely the same characters can be taken to another source of light, and placed at such distance from it that it can be read, and then a comparison between the intensity of the first source of light and the second can be made in terms of the distance of the printed matter from the sources of light, and when the instrument is used in such manner. This he calls a "liro-meter," and the terms of the distance he calls "lires."



Wellington's Arrangement of Photometers.

Fig. 1 is an elevation of the apparatus with the extension tubes in position as when the instrument is to be used as an ordinary photometer. Fig. 2 is an end elevation of the rectangular section short tube and its carrying frame. Fig. 3 is a longitudinal section of the tube and extension tubes. Fig. 4 is a sectional plan of fig. 3.

The apparatus consists of a metal base formed with feet and fixing or adjustment screws. The base supports an upper turn-table revoluble about the axis of the base and having clamping screws by which it can be fixed in the position in which it has been placed. The turn-table supports a vertical upstanding tube A carrying a telescopic rod B fixed at the desired elevation by a clamping screw. Upon the tube A is mounted a bracket C carrying a drum containing a thin steel measuring tape passing under a pulley D on the tube A. The drum may be fitted with a ratchet and pawl or some other brake device, so that the tape may be stretched with some degree of tension to avoid sagging.

The upper end of the rod B is formed with a fork, the upper ends of which form bearings for trunnions E, one upon each side of an open-ended box or tube F, one of the trunnions, extending through the bearing of its fork, being fitted with a screw by which the tube can be clamped in any angular position relatively to the horizontal plane. The tube carries a pointer G indicating upon a graduated circle to show the angle at which the tube is placed. A slot is formed in one wall of the tube extending the full diameter of it, to receive a frame adapted to carry one of the test sheets of printed matter, or to carry a sheet having a grease spot, according to the kind of test to be made.

When a "lirometer" test is to be made, the sheet of printed matter carried in H is inserted as shown at figs. 2 and 3. The apparatus is placed so that the axis of the trunnions of the tube F is horizontal, and then the tube is turned about its trunnions until its axis is in a line with the light to be tested. The apparatus is then moved nearer to or further from the source of light, "until the printed matter can easily be read with normal eye-sight," by the operator looking in at the open end of the tube.

This having been done, the distance from the source of light is measured in a horizontal direction, and the angle of the axis of the tube is taken by a reading from the graduated circle. The distance of the test sheet from the light having thus been ascertained, the efficiency of the light can be compared with others "as will be well understood."

In order to permit the same apparatus to be used as a photometer, the tube is fitted interiorally upon one side with mirrors I placed at such an angle as to reflect both sides of the sheet carried by the frame H, which then has the usual grease spot, while sighting apertures J are formed in the side of F, which are generally provided with shutters for closing them when not required.

On opposite edges of the base of F are two extending studs or brackets to receive the flattened ends of two metal tubes K provided to support extension tubes made of cardboard and blackened on the interior. These extension tubes are made slightly larger in section than F, so that their ends take over and embrace its ends. In the construction shown, one of the tubes is adapted to carry an adjustable bracket carrying an electric lamp supplied from a battery near the base of the tube A. So fitted, the apparatus can be used in the ordinary manner of a Bunsen photometer; the adjustable lamp acting as the standard light.

Supplying Air to Inverted Incandescent Gas-Lamps.

PÖSCHL, A., of Berlin.

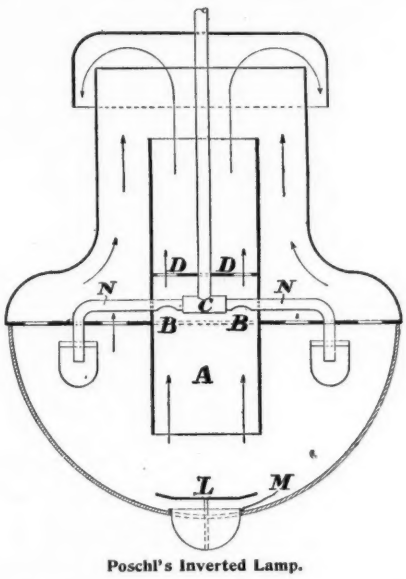
No. 14,254; June 20, 1907.

These means for supplying air to inverted incandescent gas-lamps consist of vertical plates in the form of a cross, star, or the like, arranged in a hole at the bottom of the globe of the burner, and serving as a distributor of the currents of air.

The lamp consists of a distributing piece C, suction chambers B, which open downwards, mixing-tubes N led directly outwards and then bent down with their mantles, a suction shaft A with suction holes D, a casing with chimney, cap, and gas supply pipe.

It is essential that the opening M at the bottom of the glass globe is protected in such a manner that the supply of fresh air is not cut off

from the lamp when the wind blows. For this reason vertical metal plates in the form of a cross or star are inserted in the hole, "which do away with, or neutralize, the puff of wind coming from one side and



Poschl's Inverted Lamp.

admit air at the other side on account of the vacuum which is formed." These metal plates may be provided with another distributing plate L, mounted horizontally over them.

APPLICATIONS FOR LETTERS PATENT.

5972.—Brown, T. W., "High-Pressure gas lighting."
20,109.—Robson, G., "Distance turning on and off of gas-burners." Sept. 9.
20,118.—Marsh, J., "Acetylene generators." Sept. 9.
20,139.—Feld, W., "Treatment of coal gas and analogous gases for the obtainment of extraneous matters, such as tar constituents and ammonia." Sept. 9.
20,153.—Turner, A., "Inverted burners." Sept. 10.
20,176.—Gertz, M., and Scheef, H., "Air-gas apparatus." Sept. 10.
20,199.—Bouvier, A., and Collon, E., "Mixing, measuring, and carburetting gaseous bodies." Sept. 10.
20,208.—Bailey, G. W., "Water-gas plant." Sept. 10.
20,233.—Bennett, F. I., and Tapley, W., "Suction gas producers." Sept. 11.
20,263.—Hotton, W., "Anti-vibrating fitting." Sept. 11.
20,301.—Detsinyi, G., "Gas-burners." Sept. 11.
20,316.—Smith, B., "Fuel for gas-stoves." Sept. 12.
20,322.—Nacht, S., "Geysers." Sept. 12.
20,330.—Cross, W., and Son, Ltd., and Kirby, J., "Inverted burners." Sept. 12.
20,352.—Tonkin, W. W., and Puplett, S., "Gas-producer." Sept. 12.
20,386.—Cowper-Coles, S. O., "Extraction of sulphur from sulphur compounds." Sept. 12.
20,500.—Feld, W., "Extraction of ammonia from coal gas and analogous gases." Sept. 14.

Street Lighting in Bermondsey.

The County of London Electric Supply Company, Limited, recently wrote to the Bermondsey Borough Council suggesting that the main streets of St. Olave district be lighted with 48 arc lamps. The Company pointed out that they had distributing mains in these streets, so that a detailed supply could be given at the terminals of each lamp, and the Council would therefore be relieved from all losses of distribution. The proposal would replace 133 of the existing lamps. The price suggested to be charged for current would be 1¼d. per unit for an all-night supply. The Electricity and Street Lighting Committe reported last Monday week that they had, after careful consideration of the matter, informed the Company that they were not prepared to accede to their request. The Committee further reported having had under consideration the necessity of improving the lighting of Tooley Street (one of the streets referred to by the Company), which in the early hours of the morning and late in the evening is one of the most important business thoroughfares in the borough. The lamps at present in use had been in existence for a great number of years—being the earliest incandescent gas lighting in the borough. The present condition of the burners rendered it necessary that they should be renewed almost immediately; and the Borough Surveyor suggested that each lamp be put in thorough repair, square heads substituted for the circular heads, and two No. 4 incandescent Kern burners fitted in each lamp—giving a nominal illumination of 200-candle power per lamp. The cost of this will be £70 8s. 4d., £30 of which is already provided in the estimates for the repair and renewal of the existing lamps. There are 50 lamps on the route; and the cost of the upkeep will be £5 4s. per lamp per annum. The Committee had already instructed the Surveyor to put the work in hand without delay, in anticipation of the winter season.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

The Gas-Heating Business Field.

Sir,—My attention has been called to your article and the correspondence on this subject. I am most impressed with the remarks of Mr. Harman, of Huddersfield. There can be no doubt the want of success in the introduction of gas-fires in the past should lead to an inquiry as to why this class of heating has not been more generally adopted.

Being by profession an Architect, the question of domestic heating has very frequently been one of the subjects calling for my attention. I have found that the general public as a rule have formed the opinion—right or wrong—that gas heating is too expensive a luxury to be considered. Many of those whom I have come across say they have had experience of gas-fires; but I find in most cases that the experience was gained some years ago.

Personally, I know that rapid steps have been made in the improvement of systems of lighting by gas; but I have yet to learn that progress is being made in the systems of domestic heating. If the exhibition to be held in Manchester is such as to prove that a room can be heated comfortably at a reasonable expenditure of gas, and that the expenditure can be checked by the consumer, then I believe that the makers of such appliances will have not only the support of architects, but also of the public whose wishes they have to meet.

In Mr. Harman's letter he refers to the "miserable little register stoves." He further points out that the projecting of a gas-fire into an already small bed-room is not a desirable addition. Would it not be well that manufacturers of gas-fires should examine into the whole subject, and that some leading spirit should prepare diagrams showing the present methods of heating by coal, pointing out how they could be improved, and, further, presenting a model of what they think should be the class of register grate made a standard for use and suitable for adaptation to gas-fires? If these details were worked out in a practical manner, I know from my own experience that they would be fully considered by the architectural profession, and a big step forward would have been made towards that time when gaseous fuel shall become the rule and not the exception, and when we shall be able to look back with a certain amount of satisfaction and point out that not only has domestic labour been minimized, but that the adoption of improved methods has done much to purify the air.

Nursery Road, Prestwich, Sept. 20, 1907. Harry H. Clegg.

Sir,—Anyone who has carefully followed the recent improvements in heating houses, either large or small, by means of gas-fires, in place of the old-fashioned, dirty, and laborious coal-grates, can but acknowledge that there is an immediate necessity for gas folks to bring out at once a register gas-fire. This would be most acceptable to householders as a vast saving machine—not only financially, but doing away with much fatiguing work, and at the same time rapidly heating rooms and thoroughly ventilating them.

In the past, and to a great extent to-day, the abominable canopy gas-fire holds the field; and the makers, gas authorities, plumbers, &c., are endeavouring to find out why these ancient relics do not become more popular, and why they are not at once introduced into houses by builders, in place of the ordinary coal-stove.

Facing me (in a friend's house) at this moment there is fixed a canopy fire in front of a coal-grate, which has been most carefully closed up by a sheet of iron. The flue-pipe of the fire is barely sufficient to carry away the products of combustion, and any overplus of fumes must come into the room. In addition, a certain amount of air is sucked in at the bottom of the fire, between the brick and the ornamental ironwork. This, passing upwards, gets robbed of its moisture; thereby creating a dry, unwholesome atmosphere in the room. To counteract this, it is customary to get a saucer, soup-plate, or even the dog's drinking dish, and place it in front of the gas-fire filled with water. The unhappy innocent does this, thinking to replace the moisture extracted from the air. Can anyone imagine anything more unscientific?

A distinct advance has been made with a class of fire known as registers, which practically obtain the conditions of a coal-fire. In my own house, I began with canopy gas-fires; but, owing to the smell and the evil effect on the atmosphere of the room, I was obliged to throw them out—the conditions being altogether too unhealthy. About the time when I became so disgusted with the canopy style, the register type of gas-fire came on the scene. I was willing to try anything rather than go back to the coal-grate; so the canopies were scrapped and registers were installed—care being taken that the dampers were left wide open. Since this removal, and the introduction of the register fire, the rooms have been better heated, perfectly ventilated, and consequently more habitable. My personal doctor was so charmed with the improvement that he has had all his coal-fire grates taken out and replaced by the register gas-fire; and he frequently thanks me for the vast improvement in the condition of his rooms.

An American engineer called upon me, and could not understand how a gas-fire could be in a room and yet the air remain perfectly sweet. I lighted a taper, and held it to the damper opening. It was instantly extinguished. My friend said that he guessed it was all correct, but thought the fumes of the gas-fire had helped somewhat to extinguish the flame. I therefore relighted the taper, and held it in the open space between the fire and the damper, where it remained alight. My American was convinced, and said: "You Britishers are not quite so 'darned' slow as people sometimes give you credit for."

Plumbers and fitters are sadly in want of educating as to the fixing and working of these gas-fires. My plumber knows something about drains; and he evidently thinks that drains ought to remove everything, even the products of combustion of a gas-fire, because he will insist upon completely shutting the dampers each time he overhauls the fires. For six years have I tried to convince him of the importance

of open dampers; but he is hopeless. If gas-fire manufacturers would only give one tithe of the attention they have spent upon that ancient relic, the antiquated canopy fire, to the production of an up-to-date register gas-grate—thus heating the room by radiation instead of convection—and utilizing the hot waste gases to ventilate the room, doubtless the architects whom we have been endeavouring to propitiate with unscientific and unsightly fires would be only too glad to include a scheme of gas heating in contradiction to coal-fires.

We Englishmen are inclined to be too conservative in our methods, and dearly love the old idea of the open fire-places of our forefathers. One might as well go in for halfpenny rushlights. In these days of dear coal it is time the general householder looked round for some other and better method of heating. I feel convinced that gas will supply this want; and with a good register fire, well taken up by the architects, &c., the householder will quickly appreciate the benefits given to him by the introduction of the register gas-grate.

Heaton, Sept. 21, 1907. J. STEAD HEDLEY.

John Wright and Co. and Arden Hill and Co.

SIR,—I observe in last week's "JOURNAL" reference is made to John Wright and Co. and Arden Hill and Co. as "these united concerns," an expression which I fear may be apt to create a wrong impression. Our Company includes four distinct businesses—Arden Hill and Co., the British Radiator Company, Limited, the Eagle Range Company, and John Wright and Co.—and, apart from financial arrangements, these concerns, in every other respect, carry on their businesses in an entirely distinct a way as in former years, having each their own works, management, staff, and travellers.

I am naturally wishful that the numerous friends who have for many years done business with both John Wright and Co. and Arden Hill and Co. should not be led into the error of supposing anything has taken place to diminish in any way the distinct identity (I might almost say personality) of the two firms.

Birmingham, Sept. 21, 1907. H. JAMES YATES.

LEGAL INTELLIGENCE.

VALUATION APPEALS IN SCOTLAND.

Following up our report of appeals against valuations in the South of Scotland last week, we are able to give the results of further appeals before the Valuation Committee of the Berwick County Council, sitting at Duns on the 12th inst.

The Eyemouth Gas Company appealed against a valuation of £184, as compared with £80 last year. Mr. Wood, Solicitor, objected to the Assessor taking the past year's working as a basis. Last year had been the best one the Company had had for a considerable time, and he asked for an average of (say) five years. He also thought that interest on borrowed money was a reasonable charge to come under working expenses. If this item were allowed, it would reduce the amount to £110. The Assessor said the gas-works of Berwickshire and the three southern counties had been undervalued very seriously for a number of years. He asked the Court to abide by the decided cases—taking the profits of the year, and allowing certain reductions. Interest had nothing to do with it. He referred to Dundee, Kirkcaldy, and other cases, and added that this was certainly not the year for the Company to come and ask for a reduction, when they had been underpaying to the county. Mr. Wood said the valuation of the Eyemouth Gas-Works was fixed at that Court years ago, and the Assessor had had ample opportunity of setting the matter right, the returns having been regularly made. The general practice was to take an average, and the Assessor himself had offered an average at Jedburgh only the other day. He (Mr. Wood) did not think it was right for him to do this in one case and refuse it in another. The Assessor said he was quite agreeable to take an average next year. Mr. Wood remarked that the Company were to be penalized because of the valuation of previous assessors. The Assessor pointed out that they had had the benefit.

The Duns Gas Company appealed against a valuation of £165, as against £110. Mr. J. Herriot, Solicitor, said that the former valuation was £70 for the works and £40 for the underground pipes. The Assessor had added £35 to the former, and £20 to the latter, making them £105 and £60 respectively. He was prepared to give way to the Assessor on all points except the salary of the Secretary, which he considered a necessary charge in the working expenses. The Assessor declined to accept any compromise, and said that all the cases were in his favour. Mr. Herriot said that the Assessor had greatly underestimated the capital necessary to carry on the works, and pointed out that £800 was certainly less than had been allowed in the Kirkcaldy case. The Assessor explained that in the Kirkcaldy case the Company had on their books £1000 for meters which were supplied free. In the case of Kirkcaldy, it was understood that in the event of a tenant taking over the concern, he would have to maintain these meters, and they were allowed for accordingly.

The Earlston Gas Company appealed against an assessment of £129, as compared with £70 for the past three years. Mr. A. N. M'Dougal said that prior to three years ago the valuation was £35. He pointed out that the Assessor had not made sufficient allowance for working expenses, and that in the case of Kinross the whole of the expenses of management had been allowed. In the Earlston case, he gave an abatement of 10 per cent. on £200 which a tenant would require to carry it on; but this was much too small a sum. He also allowed 20 per cent. of the tenant's profits, which left only £35 for the tenant. This meant that if a tenant were to take the works and employ a man to carry them on, he taking the oversight of the Company, his wage for the year would work out at £35. One man could not act as stoker, &c., and also as collector. He held that £95 would be little enough for his wage, and if he had to employ a man for the manufacture of the gas, there would only be £35 left as his wage. Besides, there was no allowance made for depreciation, nor for the accumulation of a fund for the renewing of plant. The £129 was not treated as profit. If it were divided up to the hilt among the proprietors, they would very soon have to put their hands into their own pockets. It would be a reasonable thing he thought for their Honours to consider what amount of this £129 was treated by the Directors as profit, and how much they divided. At 35s. a week, or (say) £70, it would be put mildly, and this without allowing anything for depreciation. In estimating the profits they must make allowance for depreciation. The return to the shareholders in this case was only £80 a year.

The Ayton Gas Company appealed against a valuation of £87, as compared with £40. The Company, he said, was the smallest among the gas companies; and this new method of valuation came much more hardly upon them than upon any of the others. In face of the Kinross case, they had to bow to the inevitable. The Secretary in the Ayton case did work which in a larger concern would be done in the manager's department. The concern was so small that the Manager was really a gas maker rather than a manager; and for the salary of ten guineas, the Secretary did the ordering of coal, paying the accounts, making out the gas bills, and so on. In certain cases one of his assistants helped the manager in the reading of meters. They held that £2 10s. might be taken as paying purely for secretarial work, and that £8 might be held as connected with the working of the concern. If their Honours were willing to put it on that basis, they would agree. If they called the Secretary by another name it would be passed, as it would go into practical working. The Assessor remarked that the Company had made £98 profit last year, the year before £118, the year before that £122, and the year before that £138. Mr. T. P. Doughty said they paid upon £40 in years when they had no profits at all, and he asked the Assessor to look farther back. The Assessor remarked that they had gone back ten years.

Their Honours retired to consider privately their decision, and were absent from the Court room a considerable time. On their return, the Chairman said the Court had decided to dismiss all the appeals.

Sandiacre Gas-Works Purchase.

As was recorded in last week's "JOURNAL," the Long Eaton Gas Company are to take over the Sandiacre gas undertaking. The "Nottingham Express" states that the price agreed upon (which is regarded as mutually satisfactory) is £17,000—subject, of course, to confirmation by the Long Eaton stockholders at the meeting which will be held. The Sandiacre undertaking, our contemporary remarks, is the property of Mr. Hooley, and is one of those instances where a private person has been empowered by Parliament to supply a district. The works were originally for the supply of a mill; and as the village expanded, so did the works. Stapleford, though adjoining, if not actually embracing, the site upon which the gas-works stand, is supplied with gas from Nottingham; but the district over which the Sandiacre gas supplying powers extend reaches right up to Long Eaton, and consequently to enable the Long Eaton Company to extend their operations in that direction it became essential for them to come to terms.

Gas v. Electricity for Library Lighting.

Last July, the legal proceedings instituted by the Lambeth Borough Council against the South London Electric Supply Corporation, Limited, in reference to the failure of the Company to carry out an undertaking made by them in 1897 to erect a dust destructor, were settled upon the following terms: (1) The Company to give to the Council free light (not power) to the extent of £1000 a year at the price of 3½d. per unit in public buildings, so long as the Order is held by the Company or their assigns. (2) The Company to wire—with fittings—the Council's libraries or other public buildings (excepting the Town Hall and Baths), making up the £1000 a year. (3) The Company to pay £300 towards the Council's out-of-pocket costs of the action. The matter was brought up again at the meeting of the Council last Thursday, when the Libraries Committee reported having had the arrangement under consideration. They suggested that in the first instance four named libraries should be wired and fitted for electric lighting; but that if the supply to the Baths and new Town Hall and such libraries should not reach £1000 a year, the Carnegie Library should be added. Otherwise, however, as the gas-fittings at the Carnegie Library were quite new, they thought gas lighting should continue there. There was, they said, one point which should be considered by the Council—the cost of electric lighting as compared with gas. It was believed that, even at 3½d. per unit, the cost of the electric light would largely exceed that of gas. The Committee did not consider that, under the circumstances, the Libraries Committee should be charged with a larger yearly sum for electric light to the general libraries than the amounts actually paid for gas; and they suggested that, to prevent difficulties and confusion in the future, the Libraries Committee should be debited yearly with an amount equal to the average cost of gas at the several libraries during the three years ended March 31 last. The report was adopted.

Public Lighting of Merthyr Tydfil.—At their last meeting, the Merthyr Tydfil Town Council considered a recommendation by the Public Works Committee that the main road from Merthyr to Dowlais should be lighted by electricity instead of gas. The Gas Company offered to light the road by 68 single-burner lamps and 10 three-light lamps at a cost of £267 per annum; the single-burner lamps to be of 100-candle power, and the three-light lamps of 300-candle power. The Electric Company's offer was £3 per lamp for two-light lamps and £6 for four-light lamps—the Council to provide the brackets and supports. Alderman Jones, in moving that the matter be referred back, asserted that gas lighting was more efficient and certainly more economical; and he argued that, as the gas-standards had been fixed at the expense of the Council, it would be a great mistake to make an alteration—especially as they had no means of comparing the cost of the rival schemes. Mr. Daniel said it would be a suicidal thing to tie themselves to the Gas Company, who had never given any concessions except under compulsion and the threat of competition. The minute was, however, referred back to the Committee.

MISCELLANEOUS NEWS.

BRITISH COALITE COMPANY'S STATUTORY MEETING.

Chairman's Explanation of the Company's Position.

The Great Hall at Salisbury House, E.C., was crowded last Friday afternoon, in response to the intimation that the Statutory Meeting of the British Coalite Company, Limited, would then be held. In fact, there were many more shareholders than were able to find seating accommodation; while quite a number of Press representatives found themselves compelled to take their notes standing at the foot of the Directors' platform. Quite early in the proceedings, there were interruptions indicating dissatisfaction on the part of various shareholders—in view of the ticket system employed, it is fair to assume that they were shareholders—and these continued at varying intervals throughout the meeting. But it must be stated that applause was also frequently and freely indulged in.

The Report.

The report furnished to the shareholders in accordance with the provision of section 12 of the Companies Act, 1900, and dated the 7th inst., stated that the number of ordinary £1 shares allotted for cash was 750,182; while the total amount of cash received by the Company in respect of them was £269,084 9s. 7d. [It will be remembered that the number of £1 shares for which subscription was invited by the prospectus was 1,500,000.] The following payments had been made in accordance with the terms of the prospectus: Purchase consideration payable in cash, £55,000; underwriting commission, £45,000; purchase of freehold land at Wednesfield, £15,500; payments on account of freehold land at Barking, £20,740; expenditure at Wednesfield, £7799 17s. 2d.; brokerage, £803 11s. 3d.; payment on account of stamp duties, £77 10s.; furniture and fittings, £385. This made a total outlay of £145,305 18s. 5d. The preliminary expenses prior to allotment were borne by the vendors. The sums of £3500 for estimated stamp duties on conveyances and assignments, and £45,803 underwriting commission and brokerage were payable by the Company; and of these amounts, £45,881 had (as shown) already been paid.

Present Position and Future Prospects.

The proceedings were presided over by the Chairman of the Company (Mr. Albert G. Kitching, J.P.); and on rising, he remarked that the shareholders would doubtless expect from him, in addition to the report just referred to, some particulars with regard to the present position and future prospects of the undertaking. "A great many particulars," one shareholder impulsively interjected. With a large company of this kind, continued the Chairman, dealing with a novel business, three months was a short period in which to make any very great progress; but even in that limited time considerable advance had been effected. Perhaps it would be best for him to take the prospectus, and go through the various points in it. First as to the Directors, they were all practical men, with long experience in the special line of business with which they would have to deal; and their interest was identical with that of the shareholders. They had not sold the shareholders anything; they had not offered to sell anybody anything. They simply asked in the prospectus anyone who wished to do so to join them in buying something which they thought valuable—and that something was the British rights of an invention for making coal smokeless. The Directors believed it to be valuable then; and they believed it to be valuable now. They knew it to be a scientific success. They believed it would be a commercial success; and they believed it would be so now. With regard to the prospectus, they adhered to every particular therein; and if they had to write it again that day, the chief alteration that would be necessary would be to make the favourable points more favourable than they were then.

The Price Paid to the Inventor.

He had noticed, said the Chairman, some criticisms with reference to the price paid to the inventor. As to this, he could only say that he had seen many prospectuses in the course of his life; but he did not remember to have seen one in which the inventor or the concessionnaire received less than he did here, and he had seen a great many in which the price paid was vastly more. To his mind the conditions of purchase were honourable, fair, and reasonable. Practically, what took place was this: The inventor said: "I have after many years of arduous labour made a great discovery. [To this a shareholder unkindly queried, "Has he?"] You find the money, and we will divide equally the profit." He even went further, and gave them nine months to test the working and ascertain if the statements made were correct. More than this, he did not get one farthing until the shareholders had received 6 per cent. on their ordinary shares. The shareholders having shown their appreciation of this statement in a most unmistakable manner, by clapping of hands, the Chairman remarked that if any proprietor was not satisfied with these terms, he had better put his money into Consols, and never venture it in commercial undertakings.

The Agreement with Messrs. Cory and Son.

Passing next to the agreement with Messrs. William Cory and Son, the Chairman admitted that this had met with a very considerable amount of criticism. In explanation of it, he said there were a large number of different industries which they would perforce affect by their new process; and there were two alternatives before them—either to endeavour to work everything themselves, and consequently enter into competition with existing businesses, or to make an agreement with some influential firms which would ensure their co-operation. They selected the latter alternative; and what they had done as regarded the coal side of the question, they would prefer to do with reference to other interests—secure co-operation instead of competition. This remark also applied to the gas companies. Having regard to all the circumstances, he thought the shareholders would admit that it was highly politic to come to an arrangement with such a firm as Messrs. Cory and Son, and to enter into an agreement whereby the Directors instructed them to buy the coal for the Company at a small commission, and had a call on the firm's plant when they required it. Then as to the disposal of "Coalite." Here, again, they pursued the policy of endeavouring to carry the trade with them, and at the same time to protect themselves against any combination of hostile interests. They had therefore stipulated that Messrs. Cory and Son should first offer the "Coalite" to the regular coal merchants for them to supply to their private customers, so that there should be no monopoly and all would be on exactly the same terms. But if for any reason the merchants were not willing to encourage its sale, Messrs. Cory and Son would be prepared to market the "Coalite" themselves. The agreement relieved the Company of all responsibility with regard to the supply of coal and its transport, and at a cost at which they could not possibly do the work themselves; and they were also relieved of the disposal of the "Coalite" within the defined area.

The Estimated Profits.

This brought the Chairman to the question of the estimated profits, regarding which he remarked that, of course, with the amount of capital actually subscribed, they could not expect to earn the profits which were anticipated if the whole of the £1,500,000 had been forthcoming. But against this there would be the smaller amount of capital on which to pay dividend. Considering the extreme depression which existed at the time the Company was floated, and the attacks made upon them by a large and influential interest which feared their competition, it was a marvel to him that the shares were taken up to such an extent as they were. The Company had about 3500 shareholders; and he did not believe that any one of those who kept his shares would ever regret having invested his money in the undertaking.

The Validity of the Patents.

A point upon which the meeting manifested considerable curiosity was the Company's patents; and dealing with this, the Chairman remarked that, realizing from the first the great importance of the validity and effectiveness of the patents, the Board at an early stage had an independent investigation made on behalf of the Company. The result entirely confirmed the previous reports, and showed that the invention of "Coalite" was not only new, but formed what was known technically in patent practice as good subject-matter for a patent. The Company's patent position had been criticized in various respects. First, it was said that the "Coalite" invention was not good subject-matter for a patent; secondly, that a patent could not be obtained; and, thirdly, that even if a patent was secured, it would be wholly invalid and ineffective. Well, the application for a patent for the "Coalite" process had been examined by the English Patent Office Examiner, and a search made by him, with the result that not a single prior patent was found that anticipated the Company's invention. This was impartial testimony as to the novelty of the invention; and in respect to the equivalent patents in the United States and Germany—where the conditions were more stringent than here—the former had been granted and sealed, and the latter had been allowed. As to the second criticism that an English patent for the "Coalite" process could not be secured, their application had been taken through every stage up to publication; and acting under the advice of eminent Counsel, they had deferred the publication of the patent to the date allowed by the Patent Office for that purpose. Before coming to this decision, exhaustive searches were made, so that the Company's advisers were able to give an absolute assurance that the English patent would be granted as a matter of course, in spite of any opposition that might be raised by interested parties against the grant. As to the third point, that even if they secured the patent it would be invalid and ineffective, this was a kind of last resource of anybody who had to make criticism. It was very vague criticism; and he could only say that they were advised their patents would be effective, and that from his own knowledge he felt confident they would be successful in upholding them, and in effectively restraining infringement by any competitor.

What has been Done.

Coming to what has been done up to the present time, the Chairman said they were now completing the purchase of the freehold land at Barking, and taking possession. The assertion that the land was most conveniently situated, for some reason or other evoked laughter from one or two of the shareholders; and there were further signs of mirth on the Chairman remarking that, in addition to the Thames being on one side and the London, Tilbury, and Southend Railway on the other, there was a useful jetty, which would require "a little strengthening." Continuing, he said the Company had accepted tenders for a considerable number of stills; and delivery of these would be commenced within a week. It was anticipated that the first unit would be ready for work by the end of November. At Wednesfield, they had bought 60 acres of freehold land; and their plant was continuing to manufacture "Coalite" day by day. When they purchased the land, it was believed there was coal underneath; and an eminent colliery engineer who had gone into the matter now advised them that of the 60 acres, 40 acres could be worked for coal, which was what was called "Staffordshire thick seam," lying immediately adjacent to the surface. The quantity was estimated at over a million tons. The price of the land was £15,500; and it was admirably situated between the Midland Railway and the Wolverhampton and Birmingham Canal.

The Company's Product.

After explaining the method of manufacturing "Coalite," the Chairman claimed as one of its advantages that it was absolutely smokeless; and this led to the exclamation from the body of the hall, "So is coke." On this point, the Chairman said coke had never been widely used, because it was difficult to ignite, and required a strong draught to keep it burning, rendering it unsuitable for domestic grates; and, in addition, it contained only about 1 per cent. of volatile matter. "Coalite" contained from 12 to 13 per cent. of volatile matter—hydrogen compounds—which endowed it with properties of easy ignition and free burning, so that it could be lighted and burnt under exactly the same conditions as ordinary coal.

"Carbo" as a Competitor.

Attempts, said the Chairman, touching upon another matter, had already been made by certain gas companies to produce imitations of "Coalite." But the most cursory examination showed they had utterly failed to manufacture a smokeless fuel, and he did not think there was anything to fear from them. "There is one," remarked the Chairman, "or perhaps I should say was one, that was supposed by its parents to be so healthy an infant that they actually gave it a name, and called it 'Carbo.' Whether little 'Carbo' is growing up strong and active, I do not know; but the papers have ceased to record his progress to youth and manhood. It was the offspring of the Gaslight and Coke Company; and, curious as it may appear, it was born just the week before our prospectus was issued. It was advertised as smokeless fuel. Whether it can be purchased now—[A Voice: "Yes."]—I am glad to see they have sent some representative here—whether it can be purchased now, and whether it is silently but surely supplanting coal, I do not know. But from its appearance and all I can learn, I think that if this is the strongest competitor we have to fear, we need not pass one sleepless night."

Press Criticisms.

Attention was next bestowed by the Chairman to the criticisms that have appeared in the Press, most of which he admitted were fair and reasonable. Such criticism he welcomed. "I think," he said, "every Board of Directors is the better for it. Everything new inevitably encounters at first a great deal of prejudice. It is especially so in the case of new inventions; and I must confess that we appear to tread on so many people's toes that I do not wonder that we have been regarded by some with suspicion and with fear. But I am confident that the more our business is examined by those who fear our competition—more especially the gas companies—the more they will see that we come as friends, and not as enemies, and that we shall be mutually helpful one to the other." Referring to another kind of criticism to which he took exception, he said: "I do not mention the names of those almost unknown papers that have attacked us. It is probable they would think it an honour to be mentioned at a meeting of shareholders such as that I have the pleasure of addressing, and would regard it as a good advertisement for their worthless vapourings. I should probably have taken no notice of these at all if some anonymous post-cards had not been addressed to many of our shareholders. This I take to be a great impertinence, for the articles referred to were not only untrue, but in my opinion they were grossly libellous. My object in mentioning this at all is that you may judge what their advice is worth, and that some of our shareholders who have been alarmed may be able to decide whether these persons are likely to be more reliable advisers than the eminent scientific and professional men whose reports—not anonymous, but duly signed by them—appeared in our prospectus." After citing as those who had so reported Mr. James Swinburne, Professor Vivian B. Lewes, Dr. Samuel Rideal, Professor Robert Smith, Sir William Preece, and Mr. Thomas Parker, the Chairman asked whether all these men were fools, or whether it was more probable that the men making the attacks without signing them would merit that name.

Cost of Working.

Two other points fell to be referred to, both of which the Chairman said were of great importance to the future prosperity of the Company. Mr. Parker had during the past three months been giving his unremitting attention to cheapening and expediting the manufacture of "Coalite." For obvious reasons, he could not go into details at this moment; but he might say that Mr. Parker had been very successful, and that in the near future they might expect to manufacture "Coalite" more expeditiously and at less cost than had been mentioned in the prospectus.

Contract with a Gas Company Foreshadowed.

The second matter which he regarded as particularly satisfactory, stated the Chairman, was that the Directors had lately been in negotiation with an important gas company with a view to erecting plant on land close to their works. A shareholder asked for the name of the Company referred to; but the Chairman said he could not give it. Continuing, the Chairman explained that the idea was to sell the gas to the company at an agreed price. He was glad to inform the shareholders that they had practically concluded the agreement; there being only a few minor details to settle. They had told him that he would be absolutely correct in making to the meeting the following announcement: "Negotiations are now in progress, and will be completed in the course of the next few days with one of the most important gas companies in the kingdom for the erection of a plant to make 500,000 cubic feet of gas per diem on advantageous terms." They would retain and themselves deal with the "Coalite" and the other bye-products. He hoped and believed that this arrangement would be followed by many agreements of a similar nature. Concluding, he said: "We are quite satisfied with the progress we have made in the limited time at our disposal; and we have absolute confidence in the future of our undertaking."

Shareholders' Questions.

Various questions were put by shareholders on the Chairman resuming his seat. One asked whether it was true that the land at Wednesfield was purchased for £5065, and resold to the Company for £15,500; and whether Mr. Parker was the gentleman who carried this transaction through. If so, he did not think the shareholders ought to be put to the loss of something like £10,000. He had also been told that the price paid for the land at Barking—£850 an acre—was very high. A second shareholder asked whether "Coalite" had any of the sulphur which existed in coke, and said he felt more satisfied after hearing the Chairman's explanation of the state of affairs than he did before. Another wished to know whether the Examiner at the Patent Office required the insertion of any reference or references to a previous patent or patents; while a fourth gentleman expressed curiosity as to whether the underwriters had any shares to pay for.

Answering the questions, the Chairman said it was set out clearly in the prospectus that the Wednesfield Construction Company bought the land at Wednesfield for £5065, and afterwards sold to the Company for £15,500. The rise in price, he took it, arose from the strong conviction that there was coal under it. At any rate, it was a good purchase for the Company. At Barking, there were a great many owners concerned, and they all had to be dealt with. The Company were assured that the land was worth what they had paid for it. "Coalite" was practically free from sulphur, but not absolutely. The answer to the query as to whether the Patent Office Examiner required the insertion of any reference or references to a previous patent or patents, was, "None whatever." The underwriters had to take up some of the shares; and they had paid a very large sum of money already. He had no doubt they would pay what more was required.

The Chairman was thanked for his services; but before this point was reached, the shareholders had related to them by one of their fellows the troubles of a gentleman who in a moment of enthusiasm ordered five bags of "Coalite." These were delivered to him by Carter, Paterson, and Co., with a demand for 9d. per bag carriage, which the would-be consumer declined to pay. What became of the "Coalite" did not transpire.

HOBART GAS COMPANY.

The report presented at the half-yearly meeting of the Hobart Gas Company, which was held on Aug. 7, stated that the balance at the credit of profit and loss account was £6404, less at debit of electric light account £357, leaving a net amount of £6047, from which the Directors recommended the payment of a dividend of 16s. per share, amounting to £4400, and the allocation of £750 to the reserve fund. Deducting these sums, and £220 for dividend tax, there would be a balance to carry forward of £677. New settings of retorts were charged with coal for the first time on May 9; and the carbonizing returns since that date showed a marked improvement—justifying the expenditure.

The Chairman (Mr. John Hamilton), in moving the adoption of the report, said the period covered by it had been a busy one in connection with reconstruction work and extensions of the mains. The new regenerative settings of retorts had been put into operation; and the results obtained were in every way satisfactory, and reflected credit upon the various contractors who supplied the plant, and especially upon their Consulting Engineer (Mr. P. C. Holmes Hunt) for the care and attention to details bestowed by him in preparing the drawings and specifications. The work of erection had been almost entirely carried out by the Company's own staff. The most profitable business to cultivate was, he held, additional consumption by present consumers. The average consumption per meter with their Company compared very unfavourably with that in the provincial towns in England and cities of a similar size in Australia and New Zealand. As the shareholders were aware, the Board last year reduced the price of gas used for cooking purposes; and it had been the practice for many years past to hire out gas-stoves at a small rental, fixing them free of cost to the consumer. They were now reaping the benefit of this policy. The number of stoves sent out from store last half year exceeded that of any similar period. They had also established a separate department for maintenance of incandescent burners. The sales of gas disclosed a steady increase; while the electric light business also showed a marked improvement. During the past half year (on March 9) the Company had reached their jubilee of gas lighting; and the occasion was celebrated by a dinner to the officers and workmen.

The report was adopted, and the Directors' fees were increased.

SIR GEORGE LIVESEY ON TRADE UNIONS.

The Threatened Railway Strike.

Writing to the "Daily Mail" on the subject of the agitation now being fostered by the Amalgamated Society of Railway Servants, and the possibility of a resultant strike, Sir George Livesey says the question arises whether it should be in the power either of the Railway Companies or the Union to stop all railway traffic, to the untold loss and danger of the public. In trades in which Unions are officially recognized, a strike or lock-out may not involve loss or danger to the public; but herein lies a complete and radical difference between these concerns and a railway or a gas company, in which a stoppage would be disastrous to the public. The parliamentary obligations of these public companies are prohibitive of a lock-out. Therefore a strike should be equally impossible, and for the same reason—that it is against the public interest. Parliament, however, while protecting the public against a lock-out, has failed to give the equally—or, in fact, more—necessary protection against a strike in the case of a railway company, though it is given to gas and water companies by the Conspiracy and Protection of Property Acts.

Continuing, he says: "Now let me ask whether it should be in the power of thirteen unknown, irresponsible railway workmen, who form the Committee of the Amalgamated Society of Railway Servants, with their Secretary and Assistant-Secretary, to stop all the railways in the kingdom—which they seem to be willing, and some of them, at least by Mr. Bell's official statement, anxious, to do at once. An immediate strike, however, would so utterly alienate public opinion that they dare not declare it, but have for the moment shunted the responsibility on to their members. But responsibility cannot be shared by 100,000 men—many of them Socialists—who will vote individually, as they are personally advised or inclined, with no sense of responsibility to the public. The Union put itself out of court by ever talking about a strike; and now, having converted the talk into a threat, the responsible heads of the Railway Companies have had a clear intimation of what recognition would mean. They now know that the Society would not hesitate, for the attainment of its own objects, to paralyze the whole trade of the country. The railway authorities realize their responsibility, as is shown by their refusal to recognize the Union; and the public should feel thankful that its interests are in such safe hands, rather than at the mercy of the irresponsible Committee and members of the Amalgamated Society of Railway Servants. My sympathies have always been with working men. I desire, in President Roosevelt's noble words, 'a righteous peace in the industrial world.' But it is not coming by way of Trade Unions. Recognition of this Union by the Companies would seriously retard its advent, for it can only come by direct dealings between employer and employed."

STOCKPORT CORPORATION GAS SUPPLY.

Report by Mr. S. Meunier.

In his sixteenth report to the Gas Committee, dealing with the operations of the Stockport Gas-Works during the year ended March 31 last, Mr. S. Meunier, the Gas Engineer, says that, though the profits, both gross and net, apparently appear to be the highest ever obtained in the history of the department, yet this is not so as regards the net, because the alteration with reference to interest and sinking fund and the equation of loans, which this year, and for the first time, have been placed to the credit of the accounts, are accountable for £4041 of the total of £17,412; so that the year 1895 still holds the record—the price of gas, however, being then rather higher. The gross profit for the year is £34,251, as against £29,735 in the previous one.

The total income was £109,863, or an increase of £4350, of which gas sales accounted for £3103; the quantity of gas accounted for being 742,830,000 cubic feet, as against 710,849,500 cubic feet, or an increase of 4·5 per cent. Coke, which up to November and December, 1906, was a stagnant market, revived enormously during tho last three months of the financial year, with the result that what on Dec. 31 showed a decreased income, finished up with an actual amount of £1853 to the good. Tar and cyanide also showed some slight advance; while ammoniacal liquor again exhibits a falling off. While the expenditure on manufacturing shows a slight increase, both in the coal and carburetted water gas, this only represents on both £992. The make per ton (10,888 cubic feet against 10,756 feet) is, however, 132 feet higher, and the unaccounted-for gas for the year is reduced by 0·62 per cent. (5·13 per cent. against 5·75 per cent.). The item of maintenance shows a decrease of £1399, mainly brought about by the fact that the new installation of inclined retorts being in progress, many of the usual repairs to the old plant, which would otherwise have had to be carried out, were rendered unnecessary. This, of course, is a saving which may not occur again to the same extent. In addition, the work at Heaton Lane was kept down as much as possible, as the new extensions will enable all the gas required over the next two or three years to be entirely generated at Portwood, with, it is anticipated, a saving both in cost and trouble. The question of the future of the Heaton Lane works should be taken into careful consideration, as, with the greatly increased output, its size and the additional costs incurred by working it militate against obtaining economical results. At the same time, the whole question of future requirements and the utilization or otherwise of the land at Portwood Drops might be taken in hand, as the present productive capacity (not including the Heaton Lane works) will be taken up in from five to six years, and the preparation of plans, obtaining powers, and carrying out of extensions will take at least two or three years. There has also been a saving of £668 on distribution, arising principally in the item of maintenance; the same amount of work on mains and services as during the previous year not having been found necessary. Meter fittings and stoves show an additional expenditure of £829, due principally to stoves; the Committee's arrangements to fix these free having brought increased business in, with consequent additional work.

The reserve fund on March 31 stood at £6355. But from this will require to be paid during the coming year various sums on capital expenditure, for which the Local Government Board would not grant powers. In addition, the retort-house roof at Portwood will require overhauling, and at the same time slightly altering, in order to add to the comfort of the workmen on the new inclined settings. Thus it is anticipated very little of this sum will be left at the end of the next financial year. Attention is again asked to this important fund, so that it may be made up to withstand, at any time, any large and exceptional expenditure, which would otherwise have to fall upon the revenue account in any one year. Since installing the Livesey washer to work Mr. Colson's process for the prevention of naphthalene, little or no trouble in respect of this has been met with; while the cyanide washer has also been altered by the makers, at their own cost, and brought into good order. The new system of inclined retorts was also completed during the year, and is now in use. Various little difficulties, inseparable from the commencement of a new system on a large scale, have been met with, but are being gradually overcome. Once the workmen are thoroughly accustomed to the plant, no further difficulty is anticipated. The new boring in the bottom of the well for works water has turned out very successful. The Pelouze and Audouin tar-extractor at Portwood was removed from the inlet to the condensers to the inlet of the cyanide washer, with greatly increased efficiency and economy of working. The latter is shown by the fact that only eight changes of purifiers were made during the year, as against twenty-four the previous year—the saving of this in wages being about £200. A temporary stove repairing and cleaning shop has been fitted up and brought into use, greatly reducing costs. In fact, the work has been so greatly expedited that the plant has also been utilized for cleaning meters, lamps, and other portions of the general apparatus.

The outlook for the ensuing year, taken on the whole, is fairly bright. On the one side, the price of coal has been raised over 2s. per ton, and new contracts which had on the completion of the old to be made for tar and liquor, unfortunately, could not be renewed on as good terms as previously. Yet the additional cost on the one hand, and the diminished revenue on the other, will, it is thought, be recouped by savings in cost of manufacture by the new plant and the anticipated better market for coke, the price of which is considerably higher than at this time last year, while the stocks throughout the North of England are, for the corresponding period, many thousands of tons less. In addition, the sales of gas continue to increase in a satisfactory manner, especially during the summer months—pointing evidently to the gradually increasing use of various types of heating appliances during hot weather.

Tables appended to Mr. Meunier's report show that the number of meters in use is 27,682, of which 10,223 are prepayment. The quantity of gas made during the past year was 782,526,000 cubic feet; the amount accounted for being 742,830,000 feet. The largest make in 24 hours was 3,772,000 feet, and the largest delivery 3,879,000 feet. The make of gas per ton was 10,888 feet, and the illuminating power 17·40 candles. The leakage amounted to 5·13 per cent. A sum of £96,073 was received for gas, including public lighting, as against £92,314 for the preceding twelve months. During the year, 6019 tons of cannel, 48,558 tons of coal, and 529,979 gallons of oil were carbonized; the residuals made for sale being: Coke 25,091 tons, tar 3694 tons, liquor 6145 tons, and sulphocyanide 89,070 lbs. At March 31, the capital account stood at £246,652. On revenue account there was an income for the past year of £109,862, and an expenditure of £75,611; the gross profit being £34,250, or 13·88 per cent. on the capital. Interest absorbed £7758 and sinking fund £8494, leaving a net profit of £17,412, or 7·06 per cent. on the capital. Of this, £13,000 was appropriated to the rates, £4312 was placed to reserve, and £100 to insurance. The price of gas is now 2s. 6d. per 1000 cubic feet within the borough, and 2s. 10d. outside, less 2d. per 1000 feet discount. Differential discounts are allowed on gas used for industrial purposes, up to 10d. per 1000 cubic feet.

HALIFAX CORPORATION GAS UNDERTAKING.

The Past Year's Accounts.

The accounts of the Gas Department of the Halifax Corporation for the year ended the 31st of March last show that the total revenue was £114,243, compared with £113,026 for the year 1905-6; while the expenditure was £71,522, against £76,077—leaving a gross profit of £42,721 compared with £36,948. The sale of gas to ordinary and prepayment consumers produced £85,534; while gas used for street lighting figures for £7299, and for public purposes and trading concerns for £1467—making a total of £94,301. But against this there was a sum of £334 paid to the Sowerby Bridge Urban District Council for gas supplied to Luddenden, and another of £876o for discount, &c.—bringing it down to £85,206. Meter-rents came to £2220; and residuals yielded £24,850. Various other items brought up the total to the amount stated above. On the expenditure side, the manufacture of gas (coal and water) came to £39,737; purification to £220; maintenance to £11,184; distribution to £6842; management, &c., to £4723; and rates, to £6461. The balance of £42,721 brought from revenue account, with a sum of £1515 on sundry accounts, is thus disposed of: Interest, &c., £19,511; sinking funds, £8412; income-tax, £917; balance, £15,175. The last-named amount added to the balance of £11,608 brought forward made a total of £26,784, out of which £5652 is transferred to the borough fund and £2826 to the district fund in relief of rates, leaving an unappropriated balance of £18,305.

Following the financial details is an analysis of the cost of gas for the years ended March 31, 1906 and 1907. The net cost of coal last year came to 1·89d. per 1000 cubic feet of gas sold, against 1·77d. before; and the total cost at the works to 14·99d., compared with 14·71d. The net cost outside the works was 5·69d., against 5·63d.; the total cost, 20·59d., against 20·34d. Adding 0·07d. for the accident insurance fund, brought the 20·59d. up to 20·66d., leaving 4·47d. as the balance of profit. At the end of March, 1906, the total cost, as already stated, was 20·34d.; the accident insurance fund came to 0 08d., deficiency on tar-works to 0·39d., the profit to 4·38d., and the total receipts to 25·19d. The gas sent out in the twelve months covered by the accounts was 867,034,000 cubic feet, of which 814,492,300 cubic feet were sold and 10,616,000 cubic feet used on the works. In the year 1905-6, the figures were: Gas sent out, 874,251,000 feet; gas sold, 797,441,800 feet; gas used on the works, 10,304,700 feet. The leakage has been reduced from 7·59 per cent. in 1905-6 to 4·82 per cent. in 1906-7. The price of gas is 2s. 3d. per 1000 cubic feet within the borough, and 3s. 1d. beyond the borough boundary, subject to a scale of discounts of 8½ to 17½ per cent. (equal to a reduction of 2¼d. to 4¾d. per 1000 cubic feet). Gas supplied through prepayment meters is 2s. 9d. per 1000 cubic feet net, inclusive of free loan of meter and cooking stove.

GAS AND WATER ADMINISTRATION AT BARRY.

Engagements of the Engineers to Terminate.

The question of the management of the Barry gas and water undertakings, which has occupied a considerable portion of the time of the Urban District Council during the past two or three months, was again discussed at the monthly meeting on the 10th and a special meeting on the 17th inst. Last July, on the recommendation of the Gas and Water Committee, it was decided to place the two departments under one Manager, and to terminate the engagements of the Gas Manager (Mr. F. M. Harris) and the Water Manager (Mr. E. W. Waite); but at the conclusion of the meeting (*ante*, p. 341), notice was given by Mr. Hogg to move the rescission of the Council's resolution approving of the recommendations of the Committee.

Accordingly at the meeting on the 10th inst., Mr. Hogg proposed that the resolution should be rescinded; while there was also a somewhat similar motion on the *agenda* in the name of the Rev. Ben Evans. Mr. Evans was not able to be present; but Mr. Hogg introduced his own motion, which he said would enable the members to retrace a step which reflection must have shown them to be hasty and unwise. The Council evidently had confidence in the justice and ability of Mr. Porter to report upon the undertakings, and some of them had read the startling statements of that gentleman; but only a few had digested them. At a special meeting of the Gas and Water Committee, when there was no discussion upon dual management—no single word of explanation or argument—it was proposed to place both undertakings under one head, in direct opposition to the views of Mr. Porter. A largely attended public meeting decided unanimously in favour of further inquiry; but on the following night, despite the views of the ratepayers, the Council, again without reason or argument, confirmed the action of the Committee, without giving the Engineers an opportunity of saying a word in defence of any charges that might be formulated against them. Was this a fair and reasonable method of dealing with old public servants? The public outside, with no opportunity of

judging, must conclude that there was something, presumably of a scandalous nature, too bad to be put into words, or the Council would never act in such a drastic manner. He, personally, had never heard any definite charge in the Council Chamber. Of course, there were rumours in the streets of mistakes in years gone by, and of the extravagant expenditure of previous Committees; but he hoped the time was far distant when the Council would transact their business on street corners or in back parlours. They had been deliberately told that if the charges were made public they would damage the Engineers in their professional capacity; but what could possibly do them greater injury than the things which the dismissal carried with it? A single-man management would be a costly mistake; for they rarely found a man who was a specialist in two things. It really seemed as if there was an attempt to get rid of the two Engineers at all costs, and to deprive the officials of an opportunity of defending themselves. The Chairman (Mr. W. J. Williams, J.P.) seconded the resolution, feeling that justice had not been meted out to the two officials; but it was lost by fifteen votes to three.

Mr. Hogg then moved the resolution standing in the Rev. Ben Evans's name—"That the Gas and Water Committee be requested to state their reasons for recommending the dismissal of the two Engineers; and that no further action be taken until those reasons, and the Engineers' reply thereto, have been received and considered by the Council." He had heard, said Mr. Hogg, within a short public life, references made to a conspiracy of silence; but never before had he had such an exemplification of it as that evening. When eleven members who did not know what had taken place were content to vote in favour of sending these men about their business without opening their mouths, he did not know how to stigmatize their conduct. He could understand it if arguments and charges had been made and responded to; but when no word was said or a blow struck, he did not know what to think. But he did expect the Chairman of the Gas and Water Committee to say something to justify their action. What could be at the bottom of it all and in the background of the minds of these men, he knew not; but if they were on the Exchange, or anywhere else, they would not exist as business men for ten minutes. In the very face of their expert, they were tearing up his report, and going in direct opposition to his suggestions. His ideal of the Barry District Council had been shattered; and the pleasure with which he looked forward to transacting business at that table had disappeared. He had been led to believe that a high moral tone pervaded the Chamber, that there was nothing underhanded, and that everything was above board; but he repeated that his ideal had fallen, and things were not what they seemed. The Chairman again was the seconder; but this time the resolution was lost by fifteen votes to two. The Clerk thereupon asked for instructions regarding the notices; and the matter was referred to the Gas and Water Committee—a special meeting of the Council to be called should any difficulty arise.

A week later a special meeting was held to consider the minutes of the Gas and Water Committee in connection with the matter. The Committee recommended that the Engineers should be given six months' notice; their engagements to terminate on March 31, 1908. Mr. Watson asked if there was any agreement by which the Engineers were entitled to 2½ per cent. on all new work. The Chairman said Mr. Harris had never spoken about any agreement. After further talk, the Rev. Ben Evans moved, as an amendment to the Committee's recommendations, that the question should be deferred until the Council had framed any accusations they had to make against the Engineers. He candidly confessed that he did not know why the officials were being dismissed. If, he said, the idea got abroad that these two men were unfairly treated, the Council would have no little difficulty in finding a capable successor. Naturally, there would be plenty of applications; but not from first-class men. He believed very strongly that the Engineers should be allowed an opportunity of answering what accusations there might be; and while he had no objections to the reasons being given in private, he would prefer to see everything as open as possible. If the men were inefficient, he would be one of the first to approve of giving them notice. Mr. Hogg having seconded, Mr. Manaton said he was sorry some of the other members had not spoken; but knowing what had taken place at recent meetings, he was not surprised at it, and he thought the Committee were very wise in keeping silent. When the report of Mr. Porter was being considered, he remembered Mr. Harris telling the Chairman of the Gas and Water Committee that if anything derogatory was said about him (Mr. Harris) he would make them pay for it—or words to that effect—and that a certain gas manager, who had been interfered with by a chairman of another gas and water committee, had obtained damages to the extent of £800. The amendment was lost on a vote being taken.

GREAT YARMOUTH GAS COMPANY.

A Souvenir.

In connection with the sale of new shares which (as duly announced in the advertising columns of the "JOURNAL") is to take place next Thursday, mention may be made of a nicely got-up and profusely illustrated souvenir of the Great Yarmouth Gas Company, a copy of which we have received. The whole business of the undertaking is dealt with, from the works to the burner; and the process of gas making is rendered clearly understandable by the uninitiated. From the pamphlet we have extracted the following particulars.

The gas lighting of Great Yarmouth was inaugurated in the year 1824, when Mr. G. S. Palmer, who was known to our grandfathers as the vendor of tar, which, in their days, was known as "Palmer's paint," contracted with the Paving Commissioners to supply the town with the new illuminant of those days. It was not until 21 years later (1845) that a Company was formed for the purpose of carrying out existing contracts or arrangements with the Commissioners under the Act of the 50th year of King George III. (1810), and for making and executing any similar contracts or arrangements with the Commissioners, for lighting the streets, highways, lanes, passages, &c., with coal gas. In 1863, the Company was incorporated by a Special Act of Parliament; and from that time onward much progress was made in the development of gas lighting, which proceeded with the continuous enlargement of the works, purchases of land, and other important matters. It was at this period of the undertaking's history that the sterling qualities of the then Secretary and Manager of the Company were specially marked. The late Mr. W. H. Willis earned the profound respect and confidence of the Directors of the concern by his hard work, consummate tact and skill, and success in administering the Company's interests during this critical and important time. As time went on, Mr. J. H. Orde succeeded as Chairman Mr. Thomas Brightwen, on that gentleman's decease; and he was followed by the late Mr. G. S. Shingles, at whose death the position was taken by the present Chairman, Mr. R. H. Inglis Palgrave, who has conducted the affairs of the Company for practically the past twenty years.

The coal used by the Company is derived from the collieries of the Marquis of Londonderry, at Seaham Harbour, and produces an excellent coke. For many years the coal supply was shipped in sailing vessels of small tonnage; the coal being delivered into hundredweight bags and carted to the Company's stores. As the requirements of the Company in this direction increased, however, it became more and more evident that new methods of handling the coal needed to be devised. Mechanical contrivances have now been adopted, not only to cheapen the cost of delivering and storing the coal, but to expedite the discharging of the collier steamers—a most important point at those times when the harbour is congested, and the quay space most valuable. Incidentally it should be stated that the Company, at considerable expense, arrange to store extra quantities of coal during certain months of the year; and by receiving no steamers in November, they assist the Fish-Wharf Committee of the Corporation, as far as possible, in their difficult task of finding berthing accommodation for the boats engaged in the herring trade. The crane employed to lift coal out of the steamers is actuated by hydraulic power at a pressure of 750 lbs. per square inch. Having deposited the fully-loaded coal-skip into a vehicle designed expressly to prevent anything like a dust nuisance, it is carted to the works, passes over a weighbridge, and is tipped into a hopper to be elevated, crushed, and delivered mechanically to a conveyor-belt running along the whole length of the coal-store. From this conveyor it is thrown off by mechanical means, at any desired point, and in such a manner as to be practically self-trimming; thus reducing the labour bill to a minimum. The coal dealt with in this way amounts to between 16,000 and 17,000 tons per annum; but the plant is comprehensively constructed to handle many times that volume—40 tons per hour, in fact, being its capacity. After being deposited in the coal-stores, there are mechanical elevators arranged to place the coal in compressed-air retort-charging machines. The coal is delivered into 20-feet retorts in a perfectly even layer, by an arrangement patented by Mr. W. J. Carpenter, the Engineer and Manager of the Company,

The retorts are in benches of eight, heated by regenerative furnaces, which are the production of the Engineer and his staff; and all the work is executed by the Company's retort-setters and workmen.

After a description of the process of gas making, the following figures are quoted to show the Company's progress:

Gas Produced.

Year.	Cubic Feet.
1886.	104,559,000
1896.	127,625,000, 22 per cent. increase
1906.	166,938,000, 30 ,, ,,

This shows a grand increase in the past twenty years of nearly 60 per cent. in the quantity of gas produced. The output in 1907 to date exceeds all previous records.

A section is then devoted to the distribution department, showrooms, offices, workshops, stores, &c.; it being pointed out that in every particular the Company undertake the sole responsibility of the distribution of the gas from the works to the consumers' burners. The maintenance system in operation is found to give every satisfaction. The Company, in lighting and extinguishing the public lamps, divide the town into eight sections; and each has its own lighter. By this system, the various important business districts of the town are lighted simultaneously; and as the reverse order is used in extinguishing, the principal parts are accordingly benefited.

Dearer Gas at Bridgwater.—The report of the Directors of the Bridgwater Gas Company for the year ended June 30 states that the net profit amounts to £3904, to which has to be added the sum of £828 brought forward, making a total of £4732. Interim dividends at the rate of 10 per cent. per annum on the "A" stock and 5 per cent. per annum on the "B" and "C" stock were paid for the first six months; and there is a balance of £3107 now to be dealt with. The Directors recommend the payment of dividends at the same rate as the interim ones, which will leave a balance of £1482, out of which it is proposed to carry £650 to the reserve fund, and the balance of £832 to the credit of next year's accounts. Considerable extensions of mains have taken place during the past year; and the Company's business has expanded very largely. To deal with the increasing business, further capital is necessary; and the sanction of the stockholders is to be sought to the raising of a sum not exceeding £6000 in debenture stock. The output of gas again shows a satisfactory increase—being 2,658,000 cubic feet more than the previous year. The sustained rise in the cost of coal has given the Directors much anxiety; and as they were only able to renew contracts at prices considerably in advance of those of last year, they have most reluctantly been compelled to announce an increase in the price of gas of 2d. per 1000 cubic feet, to take effect from Oct. 1. The Board deeply regret the death of their late colleague, Mr. G. B. Sully, who for 48 years had been connected with the Company. The vacancy thus caused in the directorate has been filled by the appointment of the Company's late Manager, Mr. J. H. Cornish, for the remainder of Mr. Sully's period of office.

MUNICIPAL ELECTRIC LIGHTING.

An Accountant's Report on the Barnstaple Undertaking.

A report upon the accounts of the Barnstaple Corporation electricity undertaking from its inauguration in 1902 to March 31, 1907, has been prepared by Mr. Hubert Leicester, chartered accountant, and circulated among the members of the Town Council. Accompanying the report are three tabulated statements in which the accounts are analyzed. One of these is a revenue account for the whole period of the undertaking's history, showing a loss (exclusive of the losses on the installation) of £1830. This includes a sum of £270 improperly charged to capital account. A noteworthy feature of this account is that, of the total income of £13,445 from sales of current, no less than £6330 has come out of the rates for public lighting. In another account Mr. Leicester gives the capital expenditure, which he finds, after the deductions of certain sums not properly chargeable under this head, comes to £31,165. The remaining statement is a balance-sheet to March 31 last, showing that there was due to the Treasurer at that date on revenue account the sum of £3017, as against which must be set certain accounts outstanding and stock in hand amounting to £1187; leaving the net loss at £1830. Mr. Leicester recommends that this sum should be reimbursed to the electricity undertaking from the rates, and that steps should be taken to obtain a loan for the amount (£294) due to the Treasurer on capital account.

In his report, Mr. Leicester first refers to the transfer of certain items of expenditure from the capital to the revenue account, and says that the Electrical Engineer agreed with him, on having the matter brought to his notice, that it would have been more correct to have charged several of the items to different accounts. Upon this point, Mr. Leicester adds: "There is a general opinion in connection with municipal accounts that the true test as to whether an item should be charged to capital is, whether the Local Government Board have sanctioned a loan therefor. In my opinion, this is not conclusive evidence, in trading concerns carried on by municipalities, that the items can safely be charged to capital. Where they are so charged, certain points must be considered which materially affect the welfare of your electricity undertaking, and which it is therefore advisable to bring to your notice." Another paragraph in this section refers to the public lighting. "With reference to the amounts charged to the Corporation for repairs, &c., in connection with the public lighting," says Mr. Leicester, "it would appear (if the Corporation pay to the electricity department the sums outstanding against them at the 31st of March last) the undertaking will have made a profit under this heading of £103. Part of this is accounted for by the fact that there is a stock on hand, in connection with the public lamps, amounting to £83; and if this stock is used upon the public lighting without making any further charge against the Corporation, the profit would then amount to £20. But there is danger that when this stock is used in repair and maintenance of public lamps, it may again be charged to the Corporation."

On the subject of depreciation, Mr. Leicester makes the following observations:—

In the accounts dealt with, no provision has been made for depreciation on capital expenditure, excepting the amount set aside annually out of revenue for the repayment of loans according to the requirements of the Local Government Board. This amount is calculated so as to exhaust each loan at the end of its prescribed period. Now electrical plant and machinery depreciate with notorious rapidity; and in many cases it happens that at the end of about ten years or less, a specific piece of machinery becomes absolutely valueless and has to be replaced, while the loan raised for its purchase remains to be paid off during the succeeding years. It may also occur that a fresh loan is granted to replace the machine—one asset thus representing two loans. Bearing these facts in mind, it will be seen that the question of depreciation becomes of great importance. In the following list, the capital expenditure is divided under its various headings, and against each is placed the percentage of depreciation which, in my opinion, should be annually written off the asset and charged against revenue: Buildings, 2 per cent.; machinery, 10 per cent.; accumulators, 10 per cent.; mains, 4 per cent.; meters, 10 per cent.; instruments, 10 per cent.; stores, 10 per cent.; preliminary expenses, 20 per cent.; office furniture, 10 per cent.; water supply, 10 per cent. The total capital expenditure to March 31, 1907 (after adjustment), amounted to £31,165. One year's depreciation, at the percentages suggested above, works out at £2170, while the total sum set aside for repayment of loans from 1903 up to March 31, 1907, only amounts to £2704, equal to £676 per annum. This, it must be remembered, forms the only existing provision for depreciation of any kind. These figures of depreciation are based upon the most careful investigation of the capital expenditure and upon the probable life of each asset. They are the result of much consideration and experience, and are approved by your Electrical Engineer.

Having thus indicated the requirements of the undertaking, if the Corporation are to meet their future liabilities, Mr. Leicester proceeds to point out that the question of depreciation is one which goes to the root of municipal trading conducted on business lines. He says:

Now the above statements are made in the full knowledge that it is not the custom of many electricity undertakings to make any provision for depreciation other than that required by the Local Government Board. This is merely a provision for an annual instalment sufficient to clear off the loans for capital expenditure at the end of the periods allotted to them. In pursuing your present policy, therefore, you are merely following the example of almost every other municipal authority in strictly adhering to the Local Government Board regulations. The measures necessary to fulfil legal requirements, however, fall far short of those necessary in order to conduct a trading undertaking on business lines, so that at least it may not be a burden to its proprietors. The latter, it is presumed, is the object with which your electricity undertaking was installed, and it is therefore highly advisable that the above facts should be placed before you for your serious consideration. If you decide to continue the undertaking without an adequate system of depreciation such as is recommended above, it is feared that before many years have elapsed you will find the borough burdened with an ever-increasing debt caused by the replacement of worn-out capital assets, and necessitating a heavy call upon the rates each year to meet the deficiency resulting from increased interest and instalments of loans. It may be asserted with confidence that it is owing to the neglect of principles such as those here advocated that many municipal trading undertakings are now in serious difficulties, and it is my opinion—an opinion based on much study and wide experience—that it is only by the adoption of such principles that you can hope to make your electricity undertaking a permanent financial success.

In conclusion, Mr. Leicester points out that the cost of production is very high compared with other works, and recommends that consideration should be given to "any scheme that would make electricity more popular with consumers" so as to reduce the average cost of production.

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 817.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
500,000	10	Apl. 11	10½	Alliance & Dublin 10 p.c.	20—21	..	5 0 0
268,324	10	,,	7⅞	Do. 7 p.c.	13½—14½	..	5 3 5
200,000	5	May 15	7	Bombay, Ltd.	6½—7	..	5 0 0
40,000	5	,,	7	Do. New, £4 paid	4⅞—5¼	..	5 6 8
50,000	10	Aug. 29	14	Bourne- 10 p.c.	27½—28½	+½	4 18 3
51,810	10	,,	7	mouth Gas B 7 p.c.	16½—17	+¼	4 2 4
53,200	10	,,	6	and Water Pref. 6 p.c.	14½—15½	..	3 17 5
380,000	Stk.	Aug. 15	12½	Brentford Consolidated	247—252	..	4 19 2
300,000	,,	,,	9⅜	Do. New	185—190	..	5 0 0
50,000	,,	,,	5	Do. 5 p.c. Pref.	115—120	..	4 3 4
206,250	,,	June 13	4	Do. 4 p.c. Deb.	103—104	..	3 17 8
220,000	Stk.	Mch. 14	11¼	Brighton & Hove Orig.	220—225	..	5 0 0
246,320	,,	,,	8¼	Do. A. Ord. Stk.	160—165	..	5 0 0
460,000	20	Apl. 11	10	British	41½—42½	..	4 14 1
104,000	Stk.	Aug. 15	6	Bromley, Ord. 5 p.c.	116—119	..	5 0 10
165,700	,,	,,	4⅜	Do. do. 3½ p.c.	87—90	..	5 0 0
500,000	10	May 15	7	Buenos Ayres (New) Ltd.	10⅞—11¼	..	6 4 5
250,000	Stk.	June 27	4	Do. 4 p.c. Deb.	93—95	..	4 4 3
150,000	20	July 12	8¼	Cagliari, Ltd.	26½—27½	..	6 0 0
100,000	10	June 13	10	Cape Town & Dis., Ltd.	11—13	..	7 13 10
100,000	10	Apl. 26	4½	Do. 4½ p.c Pref.	8—9	..	5 0 0
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.	50—52	..	5 15 5
50,000	Stk.	June 27	4½	Do. 4½ p.c. Deb. Stk.	94—96	..	4 13 9
157,150	Stk.	Aug 15	5	Chester 5 p.c. Ord.	106½—108½	..	4 12 2
1,443,280	Stk.	,, 29	5⅝	Commercial 4 p.c Stk.	101—106	..	4 16 1
560,000	,,	,,	5	Do. 3½ p.c. do.	98—103	..	4 17 1
475,000	,,	June 13	3	Do. 3 p.c. Deb. Stk.	81—83	..	3 12 3
800,000	Stk.	,,	6⅜	Continental Union, Ltd.	112—1.7	..	5 11 1
200,000	,,	,,	7	Do. 7 p c. Pref.	138—143	+2	4 17 11
460,170	Stk.	,,	5⅜	Derby Con. Stk.	123—125	..	4 8 0
55,000	,,	—	4	Do. Deb. Stk.	102—104	..	3 16 11
486,090	10	July 31	12	European, Ltd.	22½—23½	..	5 2 2
354,060	10	,,	12	Do. £7 10s. paid	17½—18½	..	4 17 4
15,181,590	Stk.	Aug. 15	4 5/16	Gas- 4 p.c. Ord.	93—95	..	4 12 7
2,600,000	,,	,,	3⅛	light 3½ p.c. max.	86—88	..	3 19 7
3,799,735	,,	,,	4	and 4 p.c. Con. Pref.	104—107	+1	3 14 9
4,193,975	,,	June 13	3	Coke 3 p.c. Con. Deb.	81—83	..	3 12 3
258,740	Stk.	Sept. 13	5	Hastings & St. L. 3½ p.c.	93—95*	..	5 2 0
82,500	,,	,,	6½	Do. do. 5 p.c.	114—117*	..	5 11 1
70,000	10	Apl. 26	11	Hongkong & China, Ltd.	15—20	..	5 10 0
4,940,000	Stk.	May 15	8	Imperial Continental	174—176	..	4 10 11
473,600	Stk.	Aug. 15	3½	Do. 3½ p.c. Deb. Red.	91—93	..	3 15 3
195,242	Stk.	Aug. 29	6	Lea Bridge Ord. 5 p.c.	110—120	..	5 0 0
300,083	,,	June 27	4	L'rpool Unit'd Deb. Stk.	108—110	..	3 12 9
561,000	Stk.	Aug. 29	10	Liverpool United A	220—222	+2	4 10 1
718,100	,,	,,	7	Do. B	160½—161½	..	4 6 8
154,736	Stk.	Feb. 14	7⅞	Maidstone 5 p.c.	142—147	..	5 3 8
75,000	5	June 27	5	Malta & Medn., Ltd.	4—4½	..	5 11 1
560,000	100	Apl. 2	5	Met. of 5 p.c. Deb.	101—103	..	4 17 1
250,000	100	,,	4½	Melbourne 4½ p.c. Deb.	101—103	..	4 7 5
541,920	20	May 30	3⅜	Monte Video, Ltd.	10½—11½	..	6 1 9
1,775,892	Stk.	Aug. 15	4⅜	Newc'tle & G'tesh'd Con.	107—108	..	4 5 7
406,025	Stk.	June 27	3⅜	Do. 3½ p.c. Deb.	90—91	..	3 16 11
15,000	10	Aug. 29	10	North Middlesex 10 p.c.	19—20	..	5 0 0
55,940	10	,,	7	Do. 7 p.c.	12½—13½	..	5 3 8
300,000	Stk.	Apl. 26	8	Oriental, Ltd.	140—145	..	5 10 4
60,000	5	Sept. 13	7	Ottoman, Ltd.	5⅞—6¾*	..	5 12 0
398,490	5	May 15	7	Primitiva Ord.	6¼—7⅛	..	4 16 7
796,980	5	July 31	5	Do. 5 p.c. Pref.	5—5⅛	..	4 15 3
488,900	100	June 1	4	Do. 4 p.c. Deb.	94—96	..	4 3 4
1,000,000	10	Apl. 26	8	River Plate Ord.	13—13⅜	..	5 18 6
312,650	Stk.	June 27	4	Do. 4 p.c. Deb.	93—95	..	4 4 3
250,000	10	Mch. 27	8	San Paulo, Ltd.	13—13⅜	..	5 18 6
125,000	50	July 1	5	Do. 5 p.c. Deb.	48—50	..	5 0 0
135,000	Stk.	Sept. 13	10	Sheffield A	242—244*	+1	4 2 0
209,984	,,	,,	10	Do. B	242—244*	+1	4 2 0
523,500	,,	,,	10	Do. C	242—244*	+1	4 2 0
70,000	10	June 13	10	South African	15—16	..	6 5 0
6,429 895	Stk.	Aug. 15	5⅛	South Met., 4 p.c. Ord.	119—121	..	4 10 11
1,895,445	,,	July 12	3	Do. 3 p.c. Deb.	81—83	..	3 12 3
201,720	Stk	Sept. 13	8	South Shields Con. Stk.	155—157*	..	5 1 11
605,000	Stk.	Aug. 15	5⅛	S'th Suburb'n Ord. 5 p.c.	115—118	..	4 13 3
60,000	,,	,,	5	Do. 5 p.c. Pref.	117—120	..	4 3 4
117,058	,,	July 12	5	Do. 5 p.c. Deb. Stk.	120—125	..	4 0 0
502,310	Stk.	May 15	5	Southampton Ord.	105—110	..	4 10 11
120,000	Stk.	Aug. 15	6½	Tottenham A 5 p.c.	120—123	..	5 9 9
398,940	,,	,,	5¼	and B 3½ p.c.	100—103	..	5 1 11
149,470	,,	June 27	4	Edmonton 4 p.c. Deb.	99—101	..	3 19 3
184,380	10	June 13	8	Tuscan, Ltd.	10¾—10⅞	..	7 8 10
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	100—102	..	4 13 0
193,742	Stk.	Aug. 29	5	Tynemouth 5 p.c. max.	107—109	..	4 11 9
30,000	Stk.	Feb. 14	8	Wands- A 5 p.c.	—	..	—
255,636	,,	Aug. 15	6½	worth B 3½ p.c.	128—133	..	4 17 9
75,000	,,	,,	5⅝	and C 3½ p.c.	—	..	—
80,075	,,	June 27	3	Putney 3 p.c. Deb. Stk.	77—80	..	3 15 0
845,872	,,	Aug. 15	5⅛	West Ham 5 p.c. Ord.	101—104	..	4 18 6
185,000	,,	,,	5	Do. 5 p.c. Pref.	118—120	..	4 3 4
228,300	,,	June 27	4	Do. 4 p.c. Deb. Stk.	100—103	..	3 17 8

Prices marked * are "Ex div."

PROPOSED ELECTRIC LIGHTING AT CARMARTHEN.

A long and lively discussion was indulged in by the members of the Carmarthen Town Council when the question of the advisability of sealing a contract with Messrs. J. B. Saunders and Co., relative to an electric lighting scheme came up for consideration.

The agreement was explained by the Town Clerk (Mr. R. M. Thomas), who said that certain alterations had been made in it. Originally there had been a heavy penalty provided if Messrs. Saunders did not carry out their undertaking within eighteen months of obtaining the Provisional Order. They objected to this; and the penalty clause was waived to a certain extent by the Council, and it was suggested that a penalty should only be recoverable in case the Contractors gave notice that they were going to proceed and did not proceed. As the contract stood, there was a definite undertaking that the scheme would be carried through. In the amendment, this was cut out by Messrs. Saunders altogether; and it was left open to them to go through with the scheme or not as they thought fit. The only security which the Council would have would be that Messrs. Saunders would have spent a certain amount of money in getting a Provisional Order, and in other preliminary expenses. The Council would then be in the position that for eighteen months they would have to wait to see whether Messrs. Saunders would go on with the work; and they would not be able to avail themselves of any other chance during that time. On the other hand, Messrs. Saunders would have been able to withdraw without any penalty. This did not seem to him (the Clerk) to be the state of things contemplated by the Council. As the contract now stood, the Contractors would have within eighteen months either to give notice of their intentions to proceed, or else to forfeit £100. If they gave notice and did not proceed, there was a much heavier penalty. There was now no distinct obligation on the part of Messrs. Saunders to carry out the contract, except that they were liable to forfeit £100, and any expenses which they would otherwise incur. Then there was a clause which he had inserted with regard to the failure of the light, and which gave the Council power to step in and take control of the works in case of any failure. His clause was that, in case of a failure for fourteen days, the Council could step in; and that in case the fault continued for six months, the Council could purchase the concern at its "scrap" value. He had inserted this clause having regard to the contingency of the Contractors going bankrupt or otherwise failing to carry out their obligations. The only material point in which the Contractors had altered this was that the Council could step in in case of a total failure; and that in the event of a purchase under such circumstances, the price to be paid would be that of a going concern. Some alterations had been made with regard to the power of assignment. Messrs. Saunders wished to have power to assign their rights and liabilities under the contract to anybody else. In that case, Messrs. Saunders would be free of all responsibility; and the Council would have nobody to look to except the assignees. The clause as now in the agreement gave Messrs. Saunders power to assign their liability for the maintenance of the light, though not the penalty for failing to instal it.

By the time the end of the discussion was reached, some of the members had become so confused that the recording of the votes proved a difficult matter. The agreement was, however, ordered to be sealed.

THE SMOKE PROBLEM

At the Sanitary Inspectors' Conference.

At the conference of the Sanitary Inspectors' Association which took place last week at Llandudno, two papers were read dealing with the question of smoke abatement.

The first of these was by Sir William B. Richmond, R.A.; and in the course of it, he remarked that coal smoke was merely waste of fuel. It was a destructive and disagreeable agent, and was as preventable as it was unnecessary. What was wanted to secure its prevention, was that public opinion—which was the governing force in all communities of the past, the present, and the future—should shake off inertia, and with one voice proclaim its determination to force the hands of the selfish or thoughtless, and oblige them to cease from abusing their prerogatives of wealth, to abstain from damaging other people's property, destroying beauty, making dirt, and obscuring the sun—the giver or disseminator of life. The absurdity of the defence of the nuisance put forward, that "smoke and commerce were inseparable," was shown by the fact that every puff of smoke from a chimney-shaft was waste; and it was therefore unbusinesslike to permit it. Those who did permit it were short-sighted as to their own interests, and inconsiderate towards others. But man did not live by bread alone. They were gifted in this country with great beauty of landscape—and especially so in regard to the very districts which had now become squalid and unhealthy owing to this smoke curse. No great change which involved the loss of intelligent hand labour was all for good; but granted that machinery was a necessity, those who employed it should be forced by public opinion, and through that by law, not to make it a nuisance, and to destroy by its fumes and smoke adjacent properties, trees, fruit gardens, churches, cathedrals, and what not. It would be said that a law which compelled the entire abolition of smoke would be unpopular. No doubt it would be to a rich minority, but it would be vastly popular to the majority; and it was a mere sophism to say that such a law would be in restraint of trade. Westminster Abbey was fast decaying from the effect upon its surface of coal smoke; and many of our cathedrals were in like plight. Yet they sat still—Parliament did, anyhow—and let this evil go on, until perhaps future generations would be done out of their just rights to the enjoyment of the great works of art given to the present generation to take care of and transmit. When the abominable demon of smoke was expelled, there would be gardens on the house

THE WORDS OF ONE BUT THE VOICE OF MANY.

TELEPHONES
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GAS OFFICES 234
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J. D. ASHWORTH.
GENERAL MANAGER

Portsea Island Gas Fittings Company Ltd
Show Rooms.
Park Road.

Portsmouth 3rd August 19 07.

Messrs Bland & Co,

London.

Gentlemen,

In reply to your inquiry regarding Blands Inverted Gas Burners I have much pleasure in adding to the testimony of same.

I think it is sufficient recommendation in itself when I say my Company have fixed upwards of 3,000 of these burners in this town during the past year. They are of a decorative design and give a most satisfactory illumination at an exceptionally low gas consumption. Regarding cost of maintenance I have found this exceptionally low, in fact far below that of the up-keep of the ordinary vertical Incandescent Gas Burner. In conclusion I have no hesitation whatever in saying that I can strongly recommend them to Gas Lighting Engineers.

Yours faithfully,

J. D. Ashworth

General Manager.

Facsimile of letter received by Bland & Co., 63, Queen Victoria Street, London, and Manchester.

tops, trees in all the streets, and fountains of pure silver water bubbling up in the squares. There would be less squalor, less drink, more outdoor healthy life, greater sanitation, and, above all, a happier people. Science taught yearly more and more the importance of sunlight; and when the man in the street was aware of that, he would not suffer to live in an atmosphere not fit for a human being, or under conditions of dirt, against which his proud spirit should revolt.

Mr. W. Nicholson, of Sheffield, who contributed the second paper—dealing with the practical question of smoke prevention—estimated that there was in the atmosphere over these islands daily thousands of tons of coal in the form of vapour; and of the 150 million tons of coal consumed annually in this country, one-third might be saved if a sensible and scientific scheme were adopted in the burning of the fuel. Owing to the crusades of the Smoke Abatement Association founded in Sheffield, due to the advocacy of the late Sir W. C. Leng, that city, which was formerly so much afflicted with the smoke nuisance, had, in consequence of the adoption of drastic measures by the Corporation, so improved that last year it had 1437 hours of sunshine, or 368 more than Manchester, 367 more than Bradford, 265 more than Glasgow, 189 more than Leeds, 186 more than Birmingham, 158 more than Edinburgh, 53 hours more than York, and 53 more than Bettws-y-coed. He alluded to a number of mechanical stokers, underfed furnaces, and other apparatus intended to bring about perfect combustion, and added that the law against smoke pollution was already almost sufficient to produce the required relief from the nuisance, provided that it was properly enforced. He recommended, however, that the law, which now only prohibited black smoke, should be made to apply also to every kind of visible smoke emitted from chimneys, and that domestic fires should be included, inasmuch as the smoke from dwelling-houses was due to defects in combustion, which might be overcome by the provision of proper grates and by proper management of the fires.

A vote of thanks was accorded to the authors; the proposer expressing a desire to know whereabouts in Sheffield the sunshine record was taken. The President (Sir James Crichton-Browne) also remarked that the towns with which Sheffield had been compared would probably like to have a very accurate definition of what was considered sunshine in Sheffield. Mr. Nicholson, in reply, however, assured the meeting that the sunshine records at Sheffield were accurately taken.

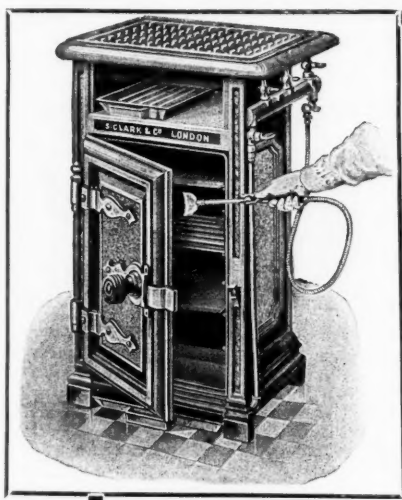
It has been pointed out, says the "Accountant," that the Prevention of Corruption Act, however excellent the intentions may have been, and undoubtedly were, with which it was passed, has had the unexpected effect of placing English firms at a considerable disadvantage in competition with foreign houses; for the latter, conducting their business from abroad, do not hesitate to avail themselves of methods which would, under the Act, be extremely risky on the part of English concerns. It would be interesting to know whether this is an oversight in the Act, or whether it was thought by the drafters that any rights of action which may exist against the recipients would effectually cover the point.

ALDERMAN GAINSFORD'S EXPERIENCES AT SHEFFIELD.

Alderman T. R. Gainsford, whose resignation of the chairmanship of the Sheffield Water Committee was recorded in our last issue, has contributed to the columns of the "Municipal Journal" a few notes of his experiences during the twenty years he occupied the position.

He states that his experience as Chairman began in 1887, just after the passing, by the House of Lords, of the Bill of the Corporation for the purchase of the water undertaking, and the rejection of the Bill of the Company for extraordinary powers, but before the former Bill went before the Second House. The Lords Committee, under the late Lord Derby, had declared that, though no default was proved against the Company, still, on grounds of public policy, the concern should be transferred to the Corporation, but that, under such circumstances, the terms of purchase must be not only fair, but liberal. Obviously, this declaration made the position very difficult for the Corporation; and the Company were strenuous in their use of it. His first determination, therefore, was not to risk a second contest in the House of Commons, but to settle the purchase by negotiation. This had to be done with a Company peculiarly unapproachable—who already had a parliamentary declaration in their favour for "liberal terms"—and it had to be settled in the very short interval between the final passing of the Bill by the House of Lords (for it was further opposed and debated in full session of that House) and the House of Commons Committee. However, he managed to do it; and the settlement, though purchasing property valued at about £2,100,000, was effected financially without any raising of cash (except about £50,000 for the trading debts and the bank overdraft), the whole capital of the Company being taken over in exchange for Corporation annuities. The terms of settlement, though much doubted at the time, and while extremely good for the shareholders of the Company, had also proved very successful for the Corporation. The House of Lords' decision in the Sheffield case fixed at least one great principle in municipal trading. Parliament had never since refused the demand of any great population to own and control its own water supply. Whatever might be said about other forms of municipal trading, at least the supply of water to a great population or trading community was now universally admitted to be rightly placed in the hands of the public authority, and its purity, fulness, and cheapness to be detached from any possible influence of either private profit or interest.

The Corporation started at Sheffield, as owners of the water undertaking, with a capital debt of about £2,100,000, and with the duty to supply water to more than 400,000 people, and to immense trading industries, with these principles: That the supply of water by the public authority ought to be conducted on ample and generous lines; that their duty was to serve the public; to be open, candid, and liberal; to acquire and to keep the confidence of the people; and to meet their wishes, even if sometimes unreasonable—bearing in mind that resistance to a public demand often only increased it. He thought they had



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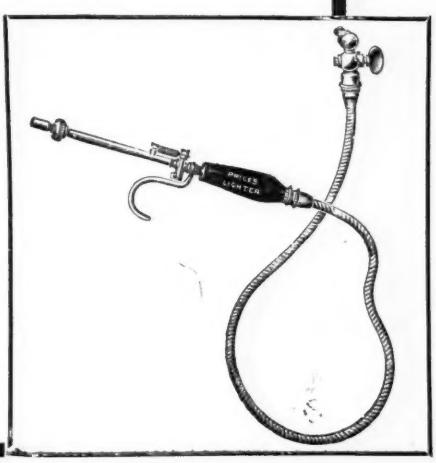

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succeeded in all this—thanks in great measure to their very able and zealous Manager, Mr. William Terrey. The charges for water had been reduced 20 to 25 per cent.; they were paying off the whole purchase, besides a further £1,000,000 of expenditure, out of revenue; they were charging the people at least £36,000 a year less than the Company in 1887 declared to be essential for existence; they gave more than £3000 worth of water a year free for sanitary purposes; and they had an accumulated profit surplus nearly three times as large as the Act of 1887 allowed, and which (with current annual profits) was expected to suffice for the provision of all future extensions and new works. Further, by their later Acts of Parliament and the new works at Langsett and Ewden, and with the Derwent Valley Water Board, they had large supplies of water for the future.

Dealing with the Corporation's parliamentary contests regarding the Little Don and Derwent areas, Alderman Gainsford emphasizes the need for preserving and utilizing to the best advantage the water-gathering areas of this country for the supply of the big populations; and he concludes by advocating the creation of a Government Department for the audit of all municipal trading accounts, which should be reasonably uniform in character.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

On another page will be found a report of the interesting proceedings which took place at Stirling last Tuesday. The company which assembled to witness the inauguration of the new plant was a small one, but contained quite a number of the gentlemen whom we are always pleased to meet on such occasions. A striking feature of the works at Stirling is the extraordinary change which has been made upon them since Mr. J. D. Smith was appointed Manager about ten years ago. He took charge of the works just as the day of commercial competition was dawning; and being fully qualified for entering upon the new order of things, and full of that courage, not of boastfulness, but of restfulness, which is the true courage, he faced the situation without hesitation. We have had, in Scotland, fairly numerous instances in which new gas-works have been erected upon new sites, greatly to the advantage of the communities served as well as of the gas undertakings, but a quiet transformation, such as we have had in Stirling, the utilization of the old site for the erection of new works of much greater capacity, is an experience not by any means unknown, but so rare that it commands attention and must be accorded credit—all the more so when it is carried out, as has been the case here, in a manner which secures both practical and financial success. The works at Stirling are so hemmed in, by the railway on one side and the town upon the two other sides of the triangular space they occupy, that extension of the area was impossible; and I am afraid that any attempt to transfer the works to a new site would have met with strenuous opposition. Mr. Smith has avoided this by bringing into play his engineering abilities; and he has, by the exercise of these, very largely increased the producing capacity of the works, and at the same time improved and cheapened the methods of working. Tuesday's proceedings were of an exceedingly pleasant nature, and the recollection of these, together with the contemplation of the possibilities opened up by the bringing into full operation of such fine works as they now possess, gives good ground for the expectation that a period of greater prosperity than they have yet experienced is in store for the Stirling Gaslight Company.

The Valuation Appeal Courts have concluded their labours for the year. These have been so unusual that note has been taken of them in the "Legal Intelligence" columns of this and last week's issues of the "JOURNAL." The interest has arisen through the action of Mr. P. Sulley, a new and energetic Assessor in the southern counties of Scotland, who has discovered circumstances existing which he has persuaded himself into believing have constituted an injustice to the local authorities. He considers that gas undertakings have been under assessed, with the consequent loss of rates; and he has set himself to remedy matters by applying his interpretations of statutes and decisions, which form the somewhat unstable medium from which assessors derive their guidance in the fixing of the valuations of industrial concerns. It will be observed that in the appeals dealt with, the Assessors have relied almost entirely upon decisions in the courts, and have given little indication that their authority is in Act of Parliament. In the varying decisions of the courts of law is to be found opportunity, if the assessor be so disposed, for the settlement of a particular case, either one way or another. Thus we find the same gentleman, who maintained at Jedburgh one day that the Melrose Gas Company should be assessed upon the average returns of five years, by which the valuation was greatly raised, two days later, at Duns, refusing to assess the Eyemouth Gas Company upon an average of years; and, pleading before different benches, he was successful in both instances, having authority behind him for taking whichever course best suited his purpose. There was another case, not connected with the gas industry, which came before one of the Valuation Committees in Lanarkshire, in which a new principle, only possible when matters are in a mixed-up condition, was involved. In this case, a large industrial undertaking had, in order to enable them to meet the more severe competition which now besets them, improved their works so that the Company are now able to produce the articles they manufacture at a cheaper rate. But as soon as they had effected this improvement, the Assessor swooped down upon them, and, upon the plea that their works were now in such a condition that a tenant would give a much higher rent for them, he raised the valuation to a degree which would have very largely counteracted any benefit the Company might have expected to derive from their improvements. From whatever point the duties of assessors may be viewed, it surely cannot be said that the Legislature ever contemplated that they were to operate, even in the slightest degree, in the direction of restraining trade. Yet that is what would have happened in the Lanarkshire case, had not the Committee

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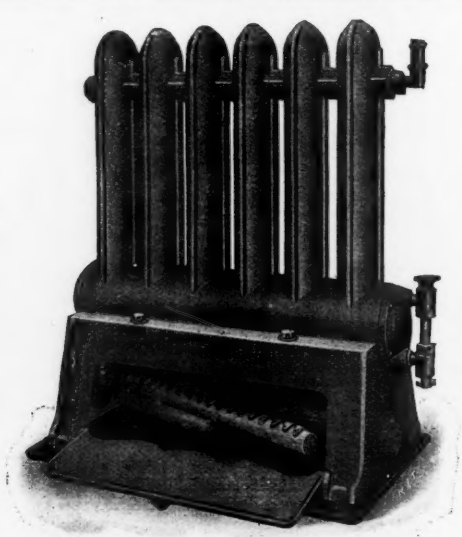

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seen the hardship of the application of hard and fast rules by the assessor, and granted a modification. A reform of the laws regulating valuation has long been wished for. The experiences this year in Scotland, to which attention has been called in the "JOURNAL," give emphasis to that wish, making it more than ever apparent that there is great need for the establishment of a guiding principle in matters of valuation, a principle which would be simple in its working and equitable in its application—two qualities which it cannot be said distinguish valuation proceedings under present conditions.

In the Falkirk Town Council on Monday, the Gas Committee recommended that the price of gas to all consumers be increased by 1d. per 1000 cubic feet from the October quarter—being for lighting 2s. 10d., cookers with ordinary meters 2s. 7d., prepayment meters 2s. 11d., power 2s. 5d., and prepayment meters for lighting 3s. 2d. Mr. Wilkie, the Convener of the Committee, in moving approval of the minutes, said they would see they had the estimates before them for the current year, and after careful consideration they accepted them as presented by the Manager (Mr. W. Wilson). Arising out of the estimates was the consideration of the price of gas for the ensuing year; and they found that it was necessary that they should make some advance. When they took into consideration the large increase of the price of coal, averaging from 2s. to 3s. per ton, they saw that 1d. per 1000 feet did not fully cover them. But they estimated that there would be a considerable saving in connection with the manufacture of gas, and they had also to take into consideration that there had been a corresponding increase in the price of coke. Referring to the annual accounts, he said that he was sorry these were not what they ought to be. As they looked over these accounts, they felt that the least said about them the better. On the coal account, though they had had an increase of close on £3000 on the estimates, when they took into consideration that the average gas manufactured turned out about 8000 cubic feet per ton, they realized that there had been a considerable loss. They must own there had been something very lax in the management of the undertaking; but, of course, there had been circumstances over which they had no control. The results of the past year had been so disastrous that they had only been able to place to the reserve fund £500; and they had had to eat into the balance carried forward from last year by nearly £1600. There was about £1500 they could hardly account for during the past year. He thought that if the estimates had been properly considered they would never have been able to lower the price of gas last year as they did (1d. per 1000 cubic feet). The greatest discrepancies were in wages and coal. The estimates for the coming year, he thought, were very carefully considered. The present Manager had kept within bounds with the probable income. He worked out his average at close on 7500 cubic feet per ton. He hoped that it would come up to very near 9000 feet. Bailie Bogle, in seconding, said Mr. Wilkie might have made his statement more clear to those who do not know the various circumstances that led up to the estimates being so very much under what they ought to have been. All of them believed that the railway communication would do away with all cartage; but they were well aware that there was a great deal of delay in getting the railway communication. This caused a very heavy cartage bill, which, of course, was not estimated for. Then many breakdowns took place, which necessitated the works being carried on by hand; and this caused a great increase in wages. There was, too, the increase of the coal bill. During the whole of the financial year, they were very much handicapped for holder room for gas; and often during November they just made sufficient gas for each day. The coal they had was quite incapable of giving gas sufficient for the town. He thought when they took all this into account they should be very thankful that they had got over as well as they had. With regard to leakage, he could explain this as due to the greater pressure of gas now; and they all knew that throughout the whole of their district the pipes were in a very bad condition. Until all their main pipes were renewed, it was almost impossible for the leakage to fall below what it was. The recommendation of the Committee was agreed to.

The Elgin gasholder question, of which so much has been heard of late, is to run its course before the Sheriff. It will be remembered that the latest phase was that the Town Council resolved, with a view to satisfying the objectors to its erection, to excavate for the tank, and so reduce the height of the holder by 15 feet. This resolution was communicated to the Agent for the objectors; and the Town Council held a special meeting on Wednesday to consider the reply which had been received from the Agent. The Deputy Town Clerk read the letter which had been received from the Agent, which was to the effect that he had consulted his clients, and was instructed to state that, while lowering the gasholder as suggested, if practicable (which his clients had reason to doubt), would mitigate, to a very limited extent, the objections to its erection where proposed, it by no means removed them; and the objectors still trusted that the Council would see their way to adopt one of the alternative suggestions made at the recent conference between the Council and the objectors. Provost Christie said he was sorry that the Council's concession had not proved acceptable, but he did not think there was any other alternative they could adopt. Bailie Gordon, the Convener of the Gas Committee, said he regretted the decision of the objectors, because he thought the Council were very liberal in making the concession they had made. He moved that the Town Clerk be instructed to present a petition to the Sheriff, intimating that a settlement had not been come to, and asking him to dispose of the petition of the Council for an order dispensing with consents. Mr. Ritchie seconded, and after discussion the motion was unanimously agreed to.

A considerable time ago it was intimated that application had been made to the Corporation of Aberdeen by the Local Authority of the somewhat distant suburb of Dyce for a gas supply. The Town Council, after inquiry, agreed to give the supply; and at a meeting on Monday they gave authority for the extension of the gas-main to Dyce, at an estimated cost of £1090.

At the Dunbar Town Council last week, it was explained that the Burgh Chamberlain had had a conference with the Assessor regarding the valuation of the gas-works, which was considered too high; and that an arrangement had been arrived at whereby the valuation had been reduced from £721 to £591.

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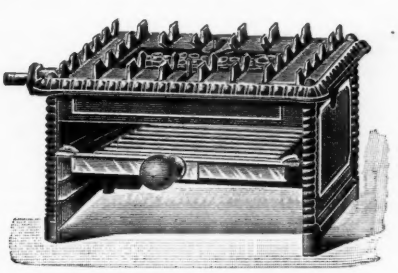

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CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Sept.* 21.

Sulphate of Ammonia.

The market remains without any special feature upon which to comment. There is no accumulation of stock at any point, and current production is being readily absorbed, but demand is not sufficient to bring about an advance in prices. The demand is, in fact, still mainly for covering September contracts, and direct orders remain scarce. Quotations at the close are consequently £11 15s. per ton f.o.b. Hull, £11 18s. 9d. per ton f.o.b. Liverpool, and £12 per ton f.o.b. Leith. There is not much doing in the forward position; buyers being indifferent in regard to October-December delivery, and unwilling to pay the premium demanded by makers for delivery over the spring months. Any orders booked are, therefore, being taken speculatively at about the level of spot prices.

Nitrate of Soda.

The market is quiet but steady, and spot prices are 11s. 1½d. and 11s. 4½d. per cwt. for 95 per cent. and refined qualities respectively.

LONDON, *Sept.* 23.

Tar Products.

There has been little change in the market for tar products during the past week. Pitch is quiet and difficult of sale on the Continent, where consumers appear to be well supplied for delivery to the end of the present year, and also report having had offers at very low figures for all over 1908. Business has been done on the east coast at 25s. to to 25s. 6d. for delivery to the end of the year; while on the west coast, 25s. has been accepted for prompt delivery. Most of the London manufacturers are out of the market; but it would be possible to buy some quantity at 26s. for prompt delivery. Creosote is steady without any alteration in prices. The Midland manufacturers are willing to sell at 3d. per gallon to the end of 1908, and will probably be able to do business at this figure before very long, as oil in this district is decidedly scarce. In the North, sales are reported at 2¾d. to 3d. per gallon, while in London 2¾d. is about the value for prompt delivery; but manufacturers will not sell very far forward. Benzol, 90 per cent., is quiet; but prices are practically unchanged. Benzol, 50-90 per cent., has been sold at prices varying from 8½d. to 9d. There is no demand whatever for toluol. Solvent naphtha is quiet. In the North, manufacturers would accept 1s. per gallon; while in London, country makes have been offered at 1s. 1d. London manufacturers would probably accept 1s. 2d. Heavy naphtha is decidedly quiet. Carbolic acid is steady. Business has been done at 1s. 7d. per gallon at manufacturers' works, for delivery over the first six months of 1908.

The average values during the week were: Tar, 15s. to 19s. 6d., *ex* works. Pitch, London, 26s. to 27s.; east coast, 25s. to 25s. 6d.; west coast, 24s. 9d. to 25s. 9d. Benzol, 90 per cent., 8d. to 8½d., casks included; 50-90 per cent., 8½d. to 9d., casks included. Toluol, 10d. to 10½d., casks included. Crude naphtha, 4d. to 4¼d. naked; solvent naphtha, 1s. to 1s. 2d., casks included; heavy naphtha, 1s. to 1s. 1d., casks included. Creosote, London, 2¾d. to 3d., naked; North, 2⅝d. to 2⅞d., naked. Heavy oils, 3d. to 3¼d., naked. Carbolic acid, 60 per cent., 1s. 8d. to 1s. 8½d., casks included. Naphthalene, £6 10s. to £8 10s., packages included; salts, 37s. 6d. to 42s. 6d., packages included. Anthracene, "A" quality, 1¼d. to 1⅝d., casks included.

Sulphate of Ammonia.

This article is steady, and there appears to be a rather firmer tone in the market during the last three or four days. The principal London Gas Companies still quote £12 1s. 3d. for prompt delivery, and £12 3s. 9d. for forward; while ordinary London makes are quoted at £11 12s. 6d. to £11 15s., on Beckton terms. In Hull, business has been done at £11 16s. 3d.; while in Liverpool, £11 17s. 6d. to £11 18s. 9d. may be taken as about the ruling value. In Leith, £12 is reported to have been refused for prompt delivery, and £12 2s. 6d. may be regarded as the ruling figure for prompt, and £12 5s. for forward delivery.

Barnstaple Water-Works.—Mr. C. E. R. Chanter, the Chairman of the Barnstaple Water Company, formally inaugurated yesterday week the new filter-bed which has been constructed in connection with the town supply. This addition to the undertaking has cost £1175. The bed is 60 feet in length by 40 feet wide, and has a filtering capacity of 150,000 to 200,000 gallons per day. The ceremony of turning the water into the bed took place in the presence of the Directors and others interested. It was pointed out that since the formation of the Company Barnstaple had had a constant and abundant water supply, which was unaffected by the most severe drought. The Company was founded in 1857, and took over an undertaking whose history dated back to 1699. The water is brought from Exmoor through several miles of leat and pipes; and the supply is sufficient to furnish 60 gallons per head per day to a population of 15,000. There is a low-level service reservoir with a capacity of 400,000 gallons; and from this the water is pumped 130 feet to a high-level service reservoir containing 300,000 gallons.

Crewkerne Water Purchase Question.—The Crewkerne Urban District Council, as the result of a long discussion at a special meeting, have passed the following resolution regarding the proposed acquisition of the local water-works, which has lately occupied much of their attention: "That, notwithstanding the report and valuation of the Water Company's undertaking by the Council's expert (Mr. Brough Taylor), at £14,335, this Council, being desirous of making the purchase, and, if possible, of avoiding the introduction of an opposing water undertaking, which must be detrimental to the shareholders of the existing Company, shall again offer £14,500 for the acquisition of the Company's works, property, and assets of all descriptions (enumerated in previous correspondence with the Water Company), with a request that the offer be accepted or declined within seven days, and that, in the event of the offer of £14,500 being not accepted, by the expiration of such seven days, the Council instruct a competent engineer to make a survey in and around the town of Crewkerne, with the view of ascertaining what supply or supplies of water can be recommended to be introduced by the Council, and to make his report thereon."

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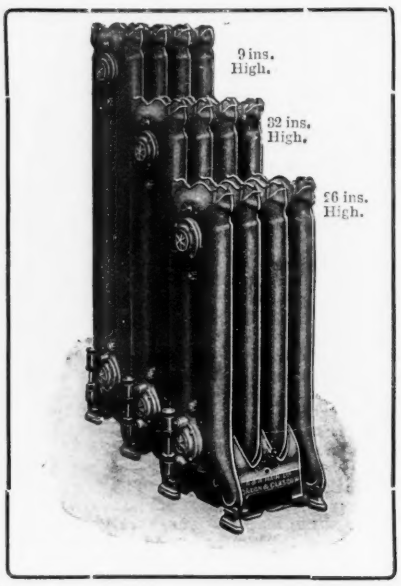

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COAL TRADE REPORTS.

Lancashire Coal Trade.

The coal trade of Lancashire was never better than it is at present; and the only fear on the part of coal proprietors is that the existing railway troubles may lead to a dislocation of carriage in the near future, in which case the coal trade would be very seriously hampered. It is reported that the Midland Railway Company have accepted the terms of the South Yorkshire coalowners for the supply of locomotive fuel at 12s. per ton, and of Nottingham and Derbyshire colliery proprietors at 11s. Last year the price was 8s. 6d. per ton for South Yorkshire coal. It is understood that the Great Northern and the Great Central Railway Companies are about to follow the example of the Midland. The struggle for coal at last year's prices has been going on since June; and the colliery proprietors have triumphed. They had obtained a position which made them independent of railway contracts. It is now certain that coal from the South Yorkshire fields for other purposes will be dearer; and, if so, Lancashire will not hesitate to follow. The demand for steam coal could not be stronger than it is. House qualities have declined in demand for the present; but it is only temporary. Little fresh gas coal and cannel are going out just now. The contracts for the year were signed several months ago, and deliveries are in accordance with requirements. There is no alteration in the average prices at the pits given last week.

Northern Coal Trade.

The coal trade is rather more active; but the milder weather has limited the consumption of some classes of fuel. In the steam coal trade, there is a steady production at the collieries, and, with steamers coming more freely forward to the loading ports, shipments are heavy, though there is still a little ease in the prices. Best Northumbrian steams are quoted from 16s. per ton f.o.b., though there are some a little lower. Second-class steams are 15s. to 15s. 3d., and steam smalls from 10s. to about 10s. 6d. Forward prices are rather uncertain, as buyers anticipate reductions such as are usual in the northern steam coal trade late in autumn, while collieries seem to be firm in their quotations. In the gas-coal trade, best kinds are very firm in price; but second-classes are perhaps a little easier. Durham gas coals vary in price from about 14s. to 15s. 9d. per ton f.o.b., according to the quality. The demand seems to be good for this season, and to show the tendency to increase that is usual at the time of lengthening nights. There is little to report as to contracts, though there are negotiations in progress for sales for export over next season. In such cases, the general quotations are below those current for the winter supply. In coke, prices are firm; and the gas coke trade is brisk, despite the increased supply. For export, 20s. per ton f.o.b. is the current quotation. Prices are higher with the inland gas producers, where values do not move so readily.

Scotch Coal Trade.

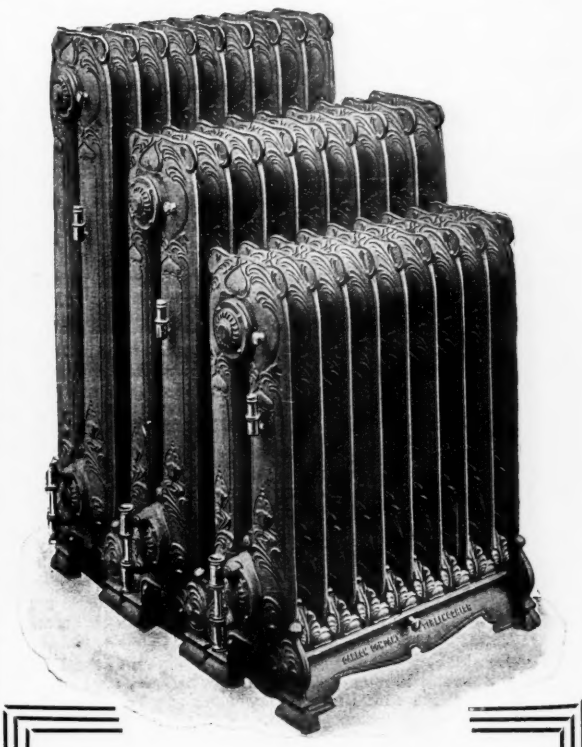
Trade proceeds upon the same lines, so far as supply and demand at home are concerned, though there are disturbing elements in the threatened strike of railway servants, and in the trouble in the shipbuilding trade. On account of both of these circumstances, manufacturers are disposed to stock as much as they can, even at the high prices ruling. The settlement of both of these difficulties with labour, if accomplished, would go far to give ease to the coal market. The prices quoted are: Ell 14s. 6d. to 16s. 6d. per ton f.o.b. Glasgow, splint 15s. to 15s. 6d., and steam 14s. to 14s. 3d. The shipments for the week amounted to 307,137 tons—a decrease of 17,186 tons upon the previous week, but an increase of 8296 tons upon the corresponding week of last year. For the year to date, the total shipments have been 10,355,670 tons—an increase of 661,658 tons upon the same period of 1906.

Scott-Snell Vacuum Gas-Compressor.—A Joint-Stock Company has recently been registered (with a capital of £5000 in £1 shares, 2500 deferred) to acquire certain rights under a provisional patent granted to C. H. Stuart and C. Scott-Snell for the United Kingdom, in respect of improvements in gas lighting. There is to be no initial public issue. The first directors are to be: C. Scott-Snell, C. H. Stuart, H. C. Booth, and F. Clench.

Gas-Works for Liphook.—An intimation has been given to the Rural Council at Petersfield, Hants, by the Solicitors to the promoter, of an intended application to the Board of Trade for a Provisional Order authorizing the construction of the necessary works with a view of supplying gas for public and private use in the Woolmer district, including Liphook, Liss, and Greatham. A suitable site has been obtained at Liphook.

Testing Consumers' Fittings at Liverpool.—At the last meeting of the Lighting Sub-Committee of the Liverpool Tramways Committee, the Superintendent of Street Lighting (Mr. A. G. Smith) reported that he had dealt with 31 applications for the testing of consumers' gas pipes and fittings since the previous meeting. Of these, 28 were found to be unsound, causing the gas to escape at the aggregate rate of $20\frac{1}{8}$ cubic feet per hour, representing an annual loss, with gas at 2s. 6d. per 1000 cubic feet, of £22 0s. 8d.

Price of Gas at Wisbech.—Some discussion has taken place at Wisbech with regard to the price which the Corporation are called upon to pay for gas; and a deputation from the Lighting Committee has waited on the Wisbech Lighting Company. When the matter came before the Town Council, the Mayor (Mr. J. Yates) said the Company were supplying them at 2s. 11d. per 1000 cubic feet, as compared with 3s. charged to private consumers. The Corporation were very large users of gas—in fact, of the total receipts of the Company one-sixth came from the Corporation; so he thought they ought to have some consideration from the Directors. The Company had not reduced the charge owing to the increased price of coal. After discussion, the contract with the Company for street lighting for a year at £3 6s. per ordinary lamp and £3 10s. per incandescent lamp, less 5 per cent. discount, was agreed to.



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Swansea Water-Works Assessment.—It is reported that the Brecon Assessment Committee have made a re-arrangement of the valuation of the Cray reservoir belonging to the Swansea Corporation; one assessment, instead of two, having been adopted, and the sum of £16,000 previously decided upon being slightly reduced. The Corporation will, however, still go on with their appeal; the reduction not being considered adequate.

Main-Laying Operations at Chagford.—At a meeting of the Okehampton Rural District Council on Saturday, a letter was read from the Devonshire Gas Association asking permission to open the streets at Chagford in order to relay the whole of the mains and make a thorough job, after which they hoped that the roads would not require to be opened again for many years. A letter was read from the Surveyor saying there was no objection to the proposal, subject to certain restrictions. These included a time-limit for the work, that there should be as little interruption of the traffic as possible, that notice be given by the contractor when the work commenced, and that the roads should be reinstated in their former condition. The Chairman said the Association should be called upon to sign these conditions in writing. The restrictions were very proper. Mr. Smith (Councillor for Chagford) remarked that it was proposed to dig up the whole town to relay the mains. It would be a great disturbance to the residents; but he supposed it was better than to go on tinkering. The application was granted, subject to signed conditions by the Association; and the Surveyor was directed to report at once to the Council any failure to comply with the stipulations.

At Hurstpierpoint, the Gas Company have agreed to supply gas at 4s. 6d. per 1000 cubic feet, and to clean, light, and extinguish the 63 public lamps for 18s. per week.

Gas is proposed to be established for public and private use at Lyndhurst, in the New Forest. It is expected, if no hitch occurs in the arrangements, that lighting will take place next February.

The Local Government Board have given sanction to the District Council at Shanklin to raise a loan for the preliminary works at Chillerton, in connection with the auxiliary water supply. The scheme will, it is expected, cost about £15,000.

The Rural District Council at Petersfield (Hants) have agreed to apply for permission to borrow £680 for the sites necessary to supply the parish of Liss with water; and the offer of the Private Works Loan Board to advance £6220, for 29 years, at 3½ per cent., for the whole scheme, was accepted.

"Water and Its Work" was the title of a University Extension Lecture delivered at Exeter last Thursday by Professor Vivian B. Lewes. Dr. Davy, the President of the British Medical Association, occupied the chair; and the lecture (which was illustrated by experiments) was enjoyed by a large audience.

The Torbay Paint Company (Messrs. Stevens and Co.) intimate that, in consequence of the death of their late esteemed partner, Mr. Herbert Firth Burrows, they have (as from July 1 last) admitted into partnership his eldest son, Mr. Spencer Freeman Burrows, who has for some years been associated with the business.

According to a telegram through Laffan's Agency, the municipal authorities of Berlin have entered on a three years' agreement with a company who propose to affix small metal advertising plates to all the lamp-posts and electric light standards in the capital. The rent charged is £1 per post. The revenue from this source is estimated to reach £10,000 per annum.

Messrs. Joseph Taylor and Co., of Bolton, have received orders from the Lincoln Corporation Gas Department and Messrs. Ingham's Thornhill Colliery, Dewsbury, for their latest makes of solid plate-lead saturators, designed for either fishing or steam ejecting, and fixed on pitch pine cradles. A further order has been placed with the firm by the Canterbury Gas Company.

The Manchester Water Committee have decided to apply for power, in the next Bill promoted by the Corporation, to carry out a scheme for dealing with flood waters in connection with the Torside and Woodhead reservoirs. This is regarded as necessary to secure the safety of the existing works. The Committee have had submitted to them a report on the subject by Mr. G. H. Hill.

In noticing a statement published in the American papers, to the effect that an experiment in profit-sharing among the operatives of the Fall River cotton mills has failed, the "Daily Express" says: "In this country there are something like a hundred firms which have profit-sharing agreements with their workers; and in many of them the scheme works smoothly. In the South Metropolitan Gas Company, for instance, the workers have submitted without demur to the reduction in their bonuses which the recent increase in the price of gas has entailed. We should like to see these experiments tried on a wider scale. They would educate the workmen to a recognition of the fact that the fluctuating lot of capital is not so easy and comfortable as the great mass of workers suppose."

Some days ago, there was a large gathering at the Victoria Hall, Exeter, to hear an organ recital and to see the place newly lighted by sixteen of the latest pattern Welsbach self-intensifying incandescent gas-lamps, of at least 500-candle power each. Those for the ground floor and the stage are suspended by steel-wire rope; and the gas is supplied through flexible tubes. They can thus be raised or lowered, or moved to any desired position. Two taps only, at the side wall, control the ten central lamps; and the whole can be turned up and down instantaneously. The stage lamps are also controlled by one tap, and can be operated similarly. The total light of the whole installation is 8000 candles; and the result is a very great improvement, every part of the hall being brilliantly and evenly lighted. This increased light has been obtained with a reduction in the consumption of gas; the quantity now required to light the hall being less than one-half of that used by the old system. The present 8000-candle light will, it is calculated, cost just over 1s. per hour.

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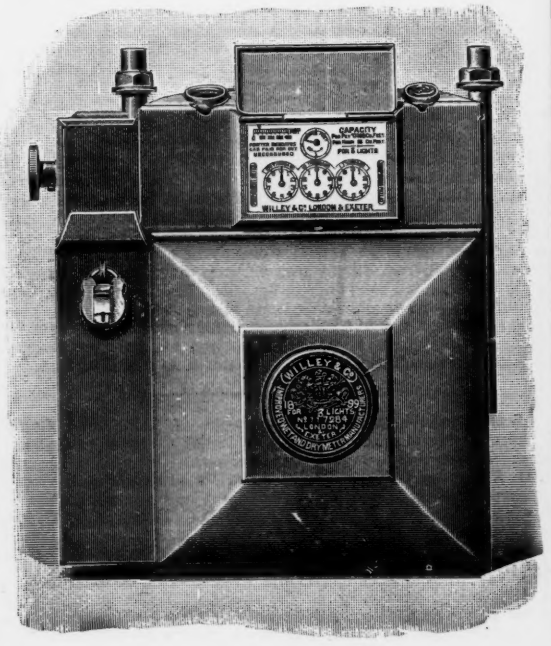

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